WEBB, ANGELA W., Ph.D. “Supporting” Beginning Secondary Science Teachers through Induction: A Multi-Case Study of Their Meaning Making and Identities. (2012) Directed by Dr. Heidi Carlone. 324 pp.

The purpose of this study was to explore the induction experiences of beginning secondary science teachers, including their afforded and enacted identities-in-practice and their meaning making. I applied a model of identities and meaning making that considered the iterative nature of the (a) normative science teacher identities afforded by induction experiences and classroom science teaching (Carlone, Haun-Frank, & Webb, 2011; Cobb, Gresalfi, & Hodge, 2006), (b) identities enacted by the beginning secondary science teachers during their participation in induction experiences and classroom science teaching, and (c) meanings they constructed of their induction experiences and classroom science teaching. Data were collected during four beginning secondary science teachers' first year of teaching and included interviews, induction activity observations, professional learning community observations, mentor/mentee meeting observations, and teaching observations.

The experiences of four beginning secondary science teachers were used to make the following arguments: First, these cases demonstrated that the beginning science teacher identities-in-practice afforded by induction supports centered mostly on policies and procedures, rather than quality instruction. Second, the beginning secondary science teachers tended to enact identities-in-practice focused on the transmission of information from their support providers to themselves. Participants' afforded and enacted identities-in-practice impacted, and were impacted by, the meanings each participant made of her induction experiences. Finally, the identities-in-practice afforded to and enacted by these

beginning secondary science teachers as well as the meanings they made of their induction experiences can be used to understand the beginning science teacher identities-in-practice they enacted during their classroom science teaching. This study adds to previous science teacher induction literature by looking beyond whether the beginning secondary science teachers were retained to how they experienced their induction, who they were asked to be during their supports and teaching, and who, ultimately, they were in these contexts.

“SUPPORTING” BEGINNING SECONDARY SCIENCE TEACHERS

THROUGH INDUCTION: A MULTI-CASE STUDY OF THEIR

MEANING MAKING AND IDENTITIES

by

Angela W. Webb

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Approved by

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Committee Chair

To my husband, Brian Webb, for believing in and encouraging my goal as his own

and

to Dr. Heidi Carlone for showing me how to achieve it.

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Chair ________________________________

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Date of Acceptance by Committee

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Date of Final Oral Examination

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

With 19.6% of teachers with no prior teaching experience and 8.1% of teachers with one to three years of experience leaving the teaching profession nationwide during the 2004-2005 academic year (Marvel, Lyter, Peltola, Strizek, Morton & Rowland, 2007) comes "the realization that it is not so much teacher recruitment that is the problem in staffing the nation's K-12 schools but teacher retention" (Cochran-Smith, 2004, p. 387). As such, attention needs to be given to successful induction experiences for beginning teachers. Carol Bartell (2005) describes induction, including both formal and informal experiences, as "the first one to three years of teaching…in which the novice becomes more familiar with their job responsibilities, the work setting, and professional norms and expectations" (p. 5). Though the pedagogical understanding of teachers develops and changes over time (Levin, 2003), the induction period is critical for beginning teachers because the "ideas, approaches, and practices learned during these early years will often be those that the teacher continues to rely upon throughout the teacher's career" (Bartell, 2005, p. 5-6).

The induction and retention of beginning teachers is especially critical for science and mathematics, with almost twice as many beginning science and mathematics teachers leaving the profession as their counterparts in other disciplines (National Commission on Teaching and America's Future & NCTAF State Partners, 2002). Julie Luft (2003, 2007,

2009) maintains that research on beginning science teachers has traditionally focused on either pre-service teachers, or more established, career in-service science teachers. She emphasizes that more attention should be given to understanding the experiences of science teachers in their induction years, thereby helping to build a more complete understanding of science teachers' continuous development processes (Luft, 2003, 2007).

Research Problem

While it is established that beginning secondary science teachers benefit from formalized induction programs (Ingersoll, 2006; Luft, Lee, Fletcher, & Roehrig, 2007; Luft & Patterson, 2002; Luft, Roehrig, & Patterson, 2003; Patterson, Roehrig, Austin, & Luft, 2003; Roehrig & Luft, 2006), little, qualitatively, is known about the nature of mentoring and other induction experiences. Though it has been demonstrated quantitatively that beginning secondary science teachers benefit from induction activities such as mentoring (Ingersoll, 2006; Luft et al., 2007; Luft & Patterson, 2002; Luft et al., 2003; Patterson et al., 2003; Roehrig & Luft, 2006) and that such activities impact teachers' knowledge and beliefs (Luft et al., 2007; Luft & Patterson, 2002; Luft et al., 2003; Patterson et al., 2003; Roehrig & Luft, 2006), more research is needed to describe and understand the qualities of induction experiences that make them effective in supporting and retaining beginning science teachers. Though induction programs have been shown to positively impact the retention of beginning secondary science teachers, such programs and experiences have a greater impact than simply keeping teachers in the classroom; they have the potential to influence how beginning secondary science teachers view themselves and their careers.

One indicator of successful induction supports—meaning-making—is frequently left out of accounts of beginning secondary science teacher induction. Since meaning-making occurs through participation in practice (Wenger, 1998), understanding the meanings beginning secondary science teachers make of their induction experiences and their roles as science teachers could give insight into the quality and success of their induction periods. Additionally, as beginning secondary science teachers negotiate the meanings of their experiences, they simultaneously conceptualize their identities-in-practice (Wenger, 1998). Therefore, the identities-in-practice beginning secondary science teachers enact during their participation in induction experiences and classroom science teaching represent another often overlooked indicator of successful induction. Focusing on beginning secondary science teachers' meaning-making and identities-in-practice affords a more nuanced way to conceptualize the effectiveness of beginning secondary science teacher induction, moving from whether beginning secondary science teachers remain in the classroom to how they experience induction, who they become and are expected to become, as science teachers.

Affordances of an Identity Lens

Though young, early-career teachers are 171% more likely than middle-aged teachers to leave the profession (Ingersoll, 2001), they are vital to reform efforts:

> [New] teachers are crucial for enacting and spreading reforms—many learn about current reform movements in their teacher education programs and thus seem most likely to be able to adopt and promote reform-oriented instruction. Supporting them in doing so effectively would help to make their early years of teaching more effective, thus improving the instruction students receive. Moreover, providing new teachers with additional support might help eventually to stem the tide of attrition. (Davis, Petish, & Smithey, 2006, p. 608)

In considering the preparation of reform-minded beginning science teachers, April Luehmann (2007) conceptualizes teacher preparation as identity development. She maintains that “the focus on professional identity affords a lens in which the breadth of one’s experiences is considered in light of how they impact one’s professional practices, values, beliefs, and commitments” (p. 827). Likewise, Brad Olsen (2008) highlights that a focus on identity “treats teachers as whole persons in and across social context who continually reconstruct their views of themselves in relation to others” (p. 5). Borrowing from Heidi Carlone and Angela Johnson (2007) to define ‘teacher professional identity’ as “being recognized by self or others as a certain kind of teacher” (Luehmann, 2007, p. 827), Luehmann contends that an identity development framework offers four primary insights to supporting beginning teachers in their development:

> People approach learning situations with core identities in place that need to align with the new identity being considered . . . Trying on a new identity within a community of practice (especially when it is counter to the norm) involves assuming risks . . . While learning as professional identity development occurs through participation in specific professional activities, not all forms of participation and engagement are equal with respect to learning potential . . . Although participation is essential for learning, learning as identity work occurs in the interpretation, narration, and thus recognition of that participation (by self and others). (p. 828)

The realities that traditional school settings provide limited opportunities for meaningful reform-oriented field experiences, prospective teachers have had little experience learning science in reform-oriented ways, and prospective teachers are likely to perceive a disconnect between their university studies of science pedagogy and their field experiences bring issues of beginning science teacher identity development to the foreground (Luehmann, 2007). In fact, “the identities teachers develop shape their dispositions, where they place their effort, whether and how they seek out professional development opportunities, and what obligations they see as intrinsic to their role” (Hammerness et al., 2005, p. 384).

During the induction period, science educators, administrators, and school personnel hope to nurture and develop beginning secondary science teachers to be certain kinds of teachers. In keeping with national reform movements (e.g., American Association of the Advancement of Science [AAAS], 1993; National Research Council [NRC], 1996) and my personal vision for science education, these would be science teachers committed to teaching science for all students through inquiry-oriented methods. Therefore, a need to attend to the identities of beginning secondary science teachers is salient, especially since identity “manifests as a tendency to come up with certain interpretations, to engage in certain actions, to make certain choices, to value certain experiences” (Wenger, 1998, p. 153). Drawing on Etienne Wenger’s (1998) concept of identity-in-practice as “learning as becoming” (p. 5), learning to become teachers is crucial for the successful induction and identity development of beginning secondary science teachers. Wenger’s notions of meaning and identity are useful in conceptualizing the relation between a beginning secondary science teacher’s learning and her practice. This lens highlights the reciprocal nature (Gee, 2000-2001; Holland, Lachicotte Jr., Skinner, & Cain, 1998; Wenger, 1998) between the beginning teacher and the practices in which she engages: As she learns through participation, this influences her identity as a teacher; as her identity forms and changes, her ideas and contributions have the potential, in turn, to impact the community of practice to which she belongs.

Using Wenger's (1998) modes of belonging—engagement, imagination, and alignment—as a framework to examine identity, this study aims to understand the meanings beginning science teachers make of their induction experiences as well as the identities-in-practice they develop through their participation in induction experiences. By exploring beginning secondary science teachers' participation in their induction and classroom science teaching (engagement), visions of themselves as science teachers (imagination), and their alignment with broader enterprises, science educators, administrators, and school personnel can develop more informed understandings of successful induction support to retain beginning secondary science teachers.

Research Questions

The purpose of this multi-case study was to understand the meanings four beginning secondary science teachers made of their induction experiences as well as the identities-in-practice they developed through their participation in induction experiences and during their classroom science teaching. I collected qualitative data (observations and interviews) during the beginning secondary science teachers' first year of teaching to address the following research questions:

Primary Research Question #1:

How do beginning secondary science teachers experience induction?

Sub-questions:

a. What meanings do beginning secondary science teachers make of their induction experiences?
b. What meanings of “science teacher” are implied by their induction experiences? In other words, what are the identity affordances of their induction experiences and supports?
c. What identities-in-practice do beginning secondary science teachers enact during their induction experiences?

Primary Research Question #2:

What identities-in-practice do beginning secondary science teachers enact during their classroom science teaching?

Summary of Chapter I

In this chapter, I described the impetus for this research study and the affordances of using an identity lens. Though it has been demonstrated quantitatively that beginning secondary science teachers benefit from formalized induction (Ingersoll, 2006; Luft et al., 2007; Luft & Patterson, 2002; Luft et al., 2003; Patterson et al., 2003; Roehrig & Luft, 2006), more research is needed to describe and understand the qualities of induction experiences that are effective in supporting and retaining beginning secondary science teachers. It is also important to consider indicators of meaningful and successful induction that go beyond retention statistics. One such indicator of success could be the meanings beginning secondary science teachers make of their induction experiences. The identities-in-practice beginning secondary science teachers enact during their induction experiences and classroom science teaching could serve as another qualitative indicator of successful induction. Beginning secondary science teachers' descriptions of their induction experiences, the meanings they make of such experiences, and the ways they come to view themselves as science teachers due to their participation in induction experiences have the potential to enhance science educators' and school administrators' understandings of the nature of effective induction experiences and may shed light on ways to better support and retain beginning secondary science teachers.

In the next chapter, I review literature on beginning teacher induction and support generally, and beginning science teacher induction and support specifically. I also develop a conceptual framework involving a situated learning perspective and Wenger's modes of belonging to inform my study.

Key Terminology

Below, I define some of the important terms used in Chapter II. These terms are also discussed further in context in the next chapter.

Induction: "The first one to three years of teaching . . . in which the novice becomes more familiar with their job responsibilities, the work setting, and professional norms and expectations" (Bartell, 2005, p. 5).

Beginning secondary science teacher: For the purposes of this study, 'beginning secondary science teacher' includes first-year science teachers who teach at the high school level.

Meaning: "A way of talking about our (changing) ability—individually and collectively—to experience our life and the world as meaningful" (Wenger, 1998, p. 5).

Identity: "A way of talking about how learning changes who we are and creates personal histories of becoming in the context of our communities" (Wenger, 1998, p. 5). Identity will be operationalized using Wenger's modes of belonging:

Engagement: "A threefold process, which includes the conjunction of 1) the ongoing negotiation of meaning, 2) the formation of trajectories, 3) the unfolding of histories of practice" (Wenger, 1998, p. 174).

Imagination: "A process of expanding our self by transcending our time and space and creating new images of the world and ourselves" (Wenger, 1998, p. 176).

Alignment: "Bridges time and space to form broader enterprises so that participants become connected through the coordination of their energies, actions, and practices" (Wenger, 1998, p. 179).

Professional Learning Community: "[I]t suggests a group of people sharing and critically interrogating their practice in an ongoing, reflective, collaborative, inclusive, learning-oriented, growth-promoting way (Mitchell & Sackney, 2000; Toole & Louis, 2002); operating as a collective enterprise (King & Newmann, 2001)" (Stoll, Bolam, McMahon, Wallace, & Thomas, 2006).

CHAPTER II

REVIEW OF LITERATURE AND CONCEPTUAL FRAMEWORK

Research on Teacher Induction and Support

Issues of retaining quality teachers in our K-12 classrooms are not new, and though significant and timely, neither are attempts to uncover and describe models for teacher retention. David Chapman and colleagues (Chapman, 1983, 1984; Chapman & Green, 1986) outline a model of teacher retention that is dependent on “a) teachers’ personal characteristics, b) educational preparation, c) initial commitment to teaching, d) quality of first teaching experience, e) professional and social integration into teaching, and f) external influences (such as employment climate)” (Chapman & Green, 1986, p. 273), with “quality of [teachers’] first teaching experience [being] more strongly related to subsequent attrition than . . . either their academic performance or the perceived adequacy of their education program” (Chapman, 1984, p. 655). Similarly, in a review of relevant literature, Yvonne Gold (1996) identifies that teacher retention

> is a function of: 1) meeting teachers unmet psychological needs (Gold, 1990; Gold & Roth, 1993); 2) amount of education (Bloland & Selby, 1980); 3) initial commitment to teaching (Chapman & Hutcheson, 1982); 4) adequacy of teacher preparation program and student teaching (Zeichner, 1980) or early teaching experience (Elliott & Steinkellner, 1979); 5) professional and social integration into teaching (Chapman & Hutcheson, 1982); and 6) the role of the administrator (Berry, Noblit & Hare, 1985). (p. 550)

Though these models of teacher retention have been identified, research on induction, support, and retention shows that teachers are dissatisfied with various aspects of these retention models, leading them to move schools or leave the teaching profession altogether.

Reasons for Teacher Attrition

In examining the 1995 Teacher Follow-up Survey (TFS) data, Richard Ingersoll (2003) discerns several reasons for job dissatisfaction as related to teacher turnover, which includes both attrition from the field and migration to another school. The top five reasons indicated in the TFS include poor salary (54.3% of all teachers surveyed; 56.7% of mathematics and science teachers surveyed); poor administrative support (42.7% of all teachers; 45.9% of mathematics and science teachers); student discipline problems (22.9% of all teachers; 29% of mathematics and science teachers); lack of faculty influence (16.5% of all teachers; 12.2% of mathematics and science teachers); and poor student motivation (14.6% of all teachers; 21.4% of mathematics and science teachers). After controlling for the type of school, low salaries; student discipline problems; little support for beginning teachers; and little faculty input in school decision making stood out as salient factors related to both migration and attrition (Ingersoll, 2003).

In a related study based on analysis of data from the 2000-2001 TFS, Ingersoll (2006) disaggregates reasons for teacher turnover. Overall, a majority (51%) of teacher turnover was due to job dissatisfaction. Reasons for dissatisfaction included the want or need for a better salary or benefits, little support for the community, disagreement with or ill-prepared to implement new reforms, dissatisfaction with workplace conditions, lack of administrator support, lack of autonomy, and lack of opportunities for professional development. The next major reason teachers indicated for leaving their previous year's school was to pursue another job (38%); this included pursuing another job within or outside of education, taking courses to improve career opportunities within or outside of education, feeling better job security at another school, and seeking the opportunity for a better teaching assignment at another school. Teachers also indicated family or personal reasons (38%), including change of residence, pregnancy/child rearing, health, or other family/personal issues, for leaving their previous year's schools. Retirement accounted for only 13% of teachers who left their schools at the end of the 1999-2000 academic year. School staffing actions, such as reductions, lay-offs, and involuntary transfers, accounted for the remaining 7% of teachers who left their previous year's school. For mathematics and science teachers, the proportions of teachers leaving for various reasons were similar to the overall population leaving their previous year's school: 50% cited dissatisfaction, 44% family or personal reasons, 30% to pursue another job, 11% retired, and 6% cited school staffing action. Similarly, in her study of beginning teachers' experiences, Susan Johnson and The Project on the Next Generation of Teachers (2004) find that those who left did so because they were "dissatisfied with their schools or overwhelmed by the demands of the job and saw few prospects for improvement or success, either in the current or in other public schools" (p. 113). Most of the teachers who moved did so because they were dissatisfied with their school or felt ineffective in their classrooms; others moved due to school staffing actions, such as staff reductions and not being reappointed (Johnson & The Project on the Next Generation of Teaching, 2004). As evidenced in the work of Ingersoll (2006) and Johnson and The Project on the Next Generation of Teachers (2004), the problem of retention—particularly related to job dissatisfaction or feelings of ineffectiveness—can be linked to insufficient induction support.

Relevance to my study. Many factors of job dissatisfaction—want or need for better salary and benefits, little support from the community, disagreement with or ill-prepared to implement reforms, dissatisfaction with workplace conditions, lack of administrator support, lack of autonomy, and lack of opportunities for professional development (Ingersoll, 2006)—can be improved at the district and school levels to make conditions more conducive to retaining secondary science teachers. Schools within the district that served as the context for this study differed based on these and other factors. For example, according to the state, one school was a priority school, two were schools of progress, and one was a school of distinction. It stands to reason that the communities within and around these schools differ, and might, consequently, impact the retention of the teachers at these schools. Do the induction supports enacted across diverse schools in the district indeed differ? If so, in what ways does the school's climate contribute to the ways in which beginning secondary science teachers experience their induction? While the literature identifies teachers' reasons for leaving, how can we better structure their teaching experiences in order to retain beginning teachers?

Strategies for Teacher Retention

To retain beginning teachers, most schools and districts have mentoring and induction programs. Based on multivariate analysis of School and Staffing Survey

(SASS) data and TFS data from two recent cycles (1994-1995 and 2000-2001), Ingersoll (2006) and Smith and Ingersoll (2004) highlight the strong link between participation in an induction program and the likelihood of a teacher moving schools or leaving the profession after the first year. The turnover rate for teachers participating in no induction was 41%. By participating in some induction activities, including subject-like mentoring, common planning, face time with school administrators, and beginners' seminars, turnover rate was reduced to 27%. For teachers receiving full induction, which included the aforementioned activities as well as an external network, reduced teaching load, and a teacher's aide, turnover rate was less than half that of teacher receiving no support. Given these demonstrated benefits of induction programs for retaining teachers, it is important to note that only 3% of beginning teachers who entered teaching during the 1999-2000 academic year received no induction support (Smith & Ingersoll, 2004), indicating schools' and districts' commitment to supporting and retaining their beginning teachers.

Though there is overwhelming support for induction programs across districts and schools, these programs can take on many forms with a great amount of variation occurring among programs (Smith & Ingersoll, 2004; Villani, 2002). In her review of several mentoring and induction programs for beginning teachers, Susan Villani (2002) establishes that mentoring and induction programs can vary in duration; whether mentors are full-time teachers, part-time mentors, or full-time mentors; mentor training; monetary remuneration for support providers; and funding, among other factors. Despite variations among induction programs (Smith & Ingersoll, 2004; Villani 2002), the core components of such programs are well agreed upon in the literature. Beginning teachers should be afforded the opportunity to interact and engage with a mentor. Mentors should be carefully selected (Bartell, 2005; Britton, Raizen, Paine, & Huntley, 2000; Darling-Hammond & Baratz-Snowden, 2005; Villani, 2002), trained and well supported (Berry, Hopkins-Thompson, & Hoke, 2002; Britton et al., 2000; Darling-Hammond & Baratz-Snowden, 2005; Moir, 2005; Villani, 2002), and purposefully paired with beginning teachers (Bartell, 2005; Johnson & The Project on the Next Generation of Teachers, 2004). According to Jian Wang and Sandra Odell (2002), mentoring should aim to improve teaching quality by focusing on standards and engaging beginning teachers in examining their beliefs and practices. In addition to having a mentor, beginning teachers and their successful induction should be supported by school and district administrators. Carol Bartell (2005) emphasizes that administrators should support the goals of induction and those who assist and mentor beginning teachers, and foster a climate for productive dialogue between mentors and beginning teachers. One way for administrators to support the goals of induction is to shelter beginning teachers by providing them with less demanding or reduced teaching assignments, additional help, and staged expectations (Berry et al., 2002; Johnson & The Project on the Next Generation of Teachers, 2004; Villani, 2002).

Relevance to my study. Although core components of induction programs are agreed upon and large-scale studies support their effectiveness (Ingersoll, 2006; Smith & Ingersoll, 2004), little is known about the ways in which beginning teachers experience these supports. While the literature provides a list of best practices for supporting and retaining beginning teachers, what do these supports look like and how do beginning teachers experience these supports in the rough and tumble of their first year of teaching? As beginning teachers engage in and experience these supports, do they make meaning of the supports as valuable and important? If so, what aspects of the supports make them important to beginning teachers? If not, then is a particular support truly a factor in inducting and retaining beginning teachers? Knowing that purposefully planned induction support is effective in retaining beginning science teachers (Ingersoll, 2006; Smith & Ingersoll, 2004), this study explored the ways in which beginning secondary science teachers experienced core components of induction as well as the meanings they ascribed to these supports, thus providing a more nuanced view of the process of beginning teacher induction.

Teachers' Perspectives on Attrition and Retention

Those for whom the aforementioned strategies, ideas, and interventions are ineffective in retaining provide valuable advice that could be useful in retaining future teachers. Based on the 1994-1995 TFS of the mathematics and science teachers who moved from or left their teaching positions, the following were frequently given as steps schools might take to encourage teachers to remain in teaching: better salary (65%), better student discipline (50%), more faculty authority (34%), and smaller class size (30%). The following were also given as steps schools might take to retain teachers, though less frequently: less paperwork (13%), mentoring for newcomers (13%), more parental involvement (12%), provide merit pay (12%), better classroom resources (11%), higher academic standards (11%), more opportunities for advancement (7%), and tuition reimbursement (6%) (Ingersoll, 2006). In alignment with Ingersoll's (2006) results, Linda

Darling-Hammond and Mistilina Sato (2006) discuss the following areas which science leaders need to address in order to retain science teachers: "quality preparation; supports, including mentoring, for beginning teachers; salaries; and working conditions, including professional teaching conditions" (p. 182).

Based on their study of beginning teachers' experiences, Johnson and The Project on the Next Generation of Teachers (2004) identify that those who stayed in teaching held a favorable view of their school despite reservations they might have concerning the teaching profession, had opportunities for professional growth and development, and felt supported and appreciated by their administration. Moreover, it was their schools' "organization to support them as they found their professional footing" that made these beginning teachers stay (Johnson & The Project on the Next Generation of Teachers, 2004, p. 117). This highlights the importance of working conditions, such as facilities, equipment, and supplies; teaching assignments; and curriculum, standards, and accountability, as well as school community in retaining teachers (Johnson & The Project on the Next Generation of Teachers, 2004; Johnson, Berg, & Donaldson, 2005). In fact, "a teacher's chance for success with her students is bound up with the features of a particular school" (Johnson & The Project on the Next Generation of Teachers, 2004, p. 117).

Susan Kardos and Susan Johnson (2007) and Johnson and The Project on the Next Generation of Teachers (2004) bring the issue of a particular school's climate to the forefront of their discussion on beginning teachers' experiences. As they explain, there exist two fundamental types of professional cultures within schools: veteran-oriented professional cultures in which professional practices are determined by veteran teachers, and novice-oriented professional cultures in which there are large numbers of beginning teachers fostering ideal and energetic professional practices. Though beginning teachers experience these two distinct cultures differently, "the result is the same: New teachers lack the guidance of experienced teachers about what or how to teach" (Kardos & Johnson, 2007, p. 2088). When beginning teachers experience an integrated professional culture, they are more likely to find the support they need to remain in the teaching profession. In an integrated professional culture, there is ongoing professional dialogue between teachers regardless of their experience levels (Johnson & The Project on the Next Generation of Teachers, 2004; Kardos & Johnson, 2007). Advantages of an integrated professional culture include mentoring and classroom observations to support beginning teachers and help them to improve their practice; novice status, which recognizes both the needs and expertise of beginning teachers and provides them sheltered opportunities to develop; and collective responsibility and interdependence as beginning teachers cooperate and collaborate among themselves as well as with experienced teachers (Johnson & The Project on the Next Generation of Teachers, 2004).

Relevance to my study. As discussed above, the literature provides us with a wealth of information regarding why teachers leave the profession, what can be done to retain them, and suggestions of best practices for the induction and mentoring of beginning teachers. Despite this information, however, beginning teachers still leave the profession at a seemingly high rate, creating a "revolving door" and costing schools with regard to the loss of instructional expertise (Ingersoll, 2006; Smith & Ingersoll, 2004).

Though Ingersoll (2006) demonstrates that mathematics and science teachers leave the teaching profession or change schools at rates only slightly higher than teachers in other fields, science remains a high-need area in terms of teacher shortages (Keller, 2003). Insight into ways to better support and retain beginning science teachers would benefit the science teaching profession, and subsequently the students in beginning science teachers' classes. In the next sections, I discuss the experiences of beginning science teachers, the challenges they face, and the ways they can be supported during their induction.

Experiences of Beginning Science Teachers

The expectations placed on beginning science teachers come from numerous sources. Currently, national science education reform documents (i.e. AAAS, 1993; NRC, 1996) stress that teachers "[help] students to develop deep conceptual understandings of learning goals while also conveying the nature of science by engaging students in authentic scientific inquiry" (Davis et al., 2006, p. 609). Additionally, beginning science teachers are expected to meet various standards, including those from the Interstate New Teacher Assessment and Support Consortium, the National Science Education Standards (NRC, 1996), and the state (North Carolina Professional Teaching Standards Commission, 2008). Striving to meet such an assortment of standards presents challenges to beginning science teachers. In their review of the literature on challenges facing pre-service and early career science teachers, Davis et al. (2006) identify five overarching themes of what science teachers are expected to do and the challenges accompanying those expectations. They conclude that beginning science teachers face challenges related to understanding the (a) content and disciplines of science, (b) learners, (c) instruction, (d) learning environments, and (e) professionalism.

With regard to challenges related to understanding the content and disciplines of science, the literature included in Davis and colleagues' review (2006) generally indicates that beginning science teachers have an unsophisticated understanding of science concepts and the nature of science. This knowledge, however, may improve over time and with experience. Based on the reviewed literature, findings also suggest that research experiences should be part of secondary science teacher preparation programs.

As related to understanding learners, beginning science teachers have varied perspectives on learners, but with support can improve their understandings of learners and learning (Davis et al., 2006). Typically, beginning science teachers have limited ideas about what to do with students' ideas and are overwhelmed about working with diverse students. However, with time beginning science teachers may come to appreciate the need to make their classrooms accessible to all learners.

In considering challenges related to understanding instruction, the literature points to a "mismatch between teachers' ideas and practices—their ideas about instruction seem generally to be more sophisticated and innovative than their actual practices" (Davis et al., 2006, p. 621). Beginning secondary science teachers, in fact, tend to focus on content and view instruction as a transmission process; however, "when new teachers have stronger subject matter knowledge, they are more likely to engage in more sophisticated teaching practice" (Davis et al., 2006. p. 622). Based on their review of relevant literature, Davis and colleagues conclude that

> new teachers face many challenges with regard to using effective instructional approaches, including lacking relevant subject matter knowledge, not knowing how to enact their instructional ideas, and being resistant to certain innovative practices. With support, though, teachers can begin to move along a positive trajectory. (2006, p. 624)

Beginning science teachers also face challenges related to understanding learning environments. They tend to want their classrooms to be student-centered, yet allow concerns over classroom management to counter this goal and frequently drive decisions. As Davis and colleagues (2006) point out, “concerns about management made teachers unlikely to engage in reform-oriented science teaching practices” (p. 629).

Relevant literature on the challenges related to understanding professionalism “includes studies about becoming a part of the community and a reflective practitioner and developing an identity and self-efficacy (a perception of one’s effectiveness) as a science teacher” (Davis et al., 2006, p. 629), showing “the importance of having supportive colleagues and engaging in reflection” (Davis et al., 2006, p. 632).

Relevance to my study. With regard to the supports provided to beginning science teachers, Davis and colleagues (2006) contend that “supports provided for teachers must be aligned with their actual needs” (p. 633). In their review of relevant literature, the following were identified as supports that could be provided beginning science teachers: supportive science coursework, supportive pre-service teacher education, supportive induction and professional development programs, action research, establishing collegial relationships, educative curriculum materials, and online support. As Davis and colleagues (2006) establish, with sufficient support during their teacher preparation and induction period, beginning science teachers can positively gain in their understandings of the content and disciplines of science, learners, instruction, learning environments, and professionalism. While Davis and colleagues (2006) do not explain the nature of "sufficient support" during beginning science teachers' teacher preparation and induction period, my study considered whether and in what ways core induction supports were beneficial to beginning secondary science teachers (from their perspectives) and how beginning science teachers made meaning of their supports. This perspective will add to the literature by illuminating how beginning science teachers experience the supports espoused in the literature.

Professional Learning Communities

One way that beginning science teachers can improve in the areas identified by Davis and colleagues (2006) is through participation in professional learning communities. There are a variety of ways to delineate "professional learning communities," which take many forms (DuFour, 2004; Stoll et al., 2006); however, Richard DuFour (2004) identifies the "big ideas" representing the core principles of professional learning communities. According to DuFour (2004),

> The professional learning community model flows from the assumption that the core mission of formal education is not simply to ensure that students are taught but to ensure that they learn . . . [E]very professional in the building must engage with colleagues in the ongoing exploration of three crucial questions that drive the work of those within a professional learning community: What do we want each student to learn? How will we know when each student has learned it? How will we know when each student experiences difficulty in learning? (p. 8)

In addition to ensuring that students learn, "Educators who are building a professional learning community recognize that they must work together to achieve their collective purpose of learning for all. Therefore, they create structures to promote a collaborative culture" (DuFour, 2004, p. 9). A primary structure that promotes a collaborative culture is time. Teachers must have time to meet throughout the school day and year to discuss their students' learning and their instructional practices. The third "big idea" of professional learning communities is a focus on results. DuFour emphasizes that "Professional learning communities judge their effectiveness on the basis of results. Working together to improve student achievement becomes the routine work of everyone in the school" (2004, p. 10). From their review of relevant literature on professional learning communities, Louise Stoll and colleagues (2006) reiterate this notion: "There appears to be broad international consensus that [professional learning community] suggests a group of people sharing and critically interrogating their practice in an ongoing, reflective, collaborative, inclusive, learning-oriented, growth-promoted way (Mitchell & Sackney, 2000; Tool & Louis, 2002)" (p. 223).

Diane Wood (2007) focuses on the specifics of teacher learning in communities that center on knowledge-of-practice (Cochran-Smith & Lytle, 1999). As described by Wood (2007), "Teacher learning communities, such as professional networks, critical friends groups, study groups, and teacher research collaboratives, provide settings for teachers to learn and build knowledge together. Teachers are not simply constructed as learners; they also become knowers" (p. 284). Several of the initiatives Wood (2007) discusses are evident in education in general and science education specifically, including professional networks (Elster, 2009; Lakshmanan, Heath, Perlmutter, & Elder, 2011;

Little, 2003) and critical friends group (Supovitz, 2002; Windschitl, Thompson, & Braaten, 2011).

Focused on science-specific learning communities and professional networks, Doris Elster (2009) studies teachers' professional development within the context of biology program reform, concluding "that the learning communities have inspired and supported the participating biology teachers to change their teaching towards a more competency-oriented and student-based teaching" (p. 53). In fact, science teachers participating in learning communities and other science-focused professional development integrate greater varieties of teaching methods, particularly those encouraging problem solving and self-directed learning (Elster, 2009), and demonstrate increased efficacy with teaching in reformed-based ways (Lakshmanan et al., 2011).

In addition to professional learning communities for the purposes of creating and/or expanding professional networks within and across schools, others go about developing communities of instructional practice through critical friends groups (Supovitz, 2002; Windschitl et al., 2011). Windschitl et al. (2011) describe the ways eleven secondary science teachers used critical friends group protocols to engage in collegial analysis of student work over the course of two years. Exploring the conditions of analysis and conversations that lend themselves to teachers' deeper understandings of ambitious practices that impact students' performance and learning, Windschitl et al. conclude that "pre-service and first year teachers are capable of productively analyzing student work, and more importantly that these analyses can play a significant role in helping some teachers develop expert-like classroom repertoires early in their career" (p.

15). Furthermore, Windschitl and colleagues attest that “those who begin their careers with a problematized view of the relationships between teaching and learning are not only more likely to appropriate sophisticated practices early, but also to benefit from evidence-based collaborative inquiry into practice” (p. 1).

Relevance to my study. Such collaborative inquiry was intended by the school district that served as the context for this study to occur during professional learning communities. However, just as the enactment of core induction supports differs by induction program (Villani, 2002), professional learning communities were differentially enacted across teachers’ schools in this study. Each professional learning community discussed in Chapter IV aligned with DuFour’s (2004) “big ideas” for professional learning communities to various degrees.

Given this, it would be no surprise if beginning secondary science teachers found their professional learning communities more or less meaningful and transformative based on their context. Randy Yerrick, Rebecca Ambrose, and Jennifer Schiller (2008) present the challenges faced by pre-service elementary science teachers whose community experiences were less than transformative. Their “challenges of transference for newcomers” include that “redefining expertise in science teaching requires shifts in pre-service teachers’ identities” (Yerrick et al., 2008, p. 146); “competing notions of legitimate peripheral participation leave newcomers’ identities intact” (Yerrick et al., 2008, p. 149); and “logistic constraints contributed to the resistance to changing beliefs about teaching’ (Yerrick et al., 2008, p. 152). Therefore, discussions of beginning teachers’ socialization within communities of practice reinforce a need to examine beginning teachers' participation within those communities and the identities they develop during such participation, both focal points of this study. In this study, I explored the conceptions of professional learning communities at the beginning secondary science teachers' schools, ways in which the beginning secondary science teachers participated in their professional learning communities, and the meanings they ascribed to this experience. Do various enactments of professional learning communities lend themselves to differential participation and valuing of the professional learning communities on the part of the beginning secondary science teachers?

Robert Noyce Teacher Scholarship Program

Another pre-service preparation and in-service support that serves to support beginning science teachers in the challenges identified by Davis and colleagues (2006) is the National Science Foundation's (NSF) Robert Noyce Teacher Scholarship program. As described in the program solicitation,

> the Robert Noyce Teacher Scholarship program seeks to encourage talented science, technology, engineering, and mathematics [STEM] majors and professionals to become K-12 mathematics and science teachers. The program provides funds to institutions of higher education to support scholarships, stipends, and programs for students who commit to teaching in high-need K-12 school districts. (NSF, 2008, p. 2)

Originally authorized under the NSF Authorization Act of 2002 and reauthorized under the America COMPETES Act of 2007, the Robert Noyce Teacher Scholarship program responds to the need for quality STEM teachers in the country's high-need K-12 classrooms and schools (NSF, 2008). Citing that "approximately one-third of all new math and science teachers leave teaching within the first three years (Committee on

Prospering in the Global Economy of the 21st Century, 2006)" (NSF, 2008, p. 6), the Robert Noyce Teacher Scholarship program is not only committed to recruiting quality STEM teachers, but also to retaining them through induction support.

There are essentially three ways the Robert Noyce Teacher Scholarship program recruits and supports talented STEM majors and professionals into teaching:

> [by] provid[ing] scholarships for juniors and seniors who are majoring in science, technology, engineering, or mathematics (STEM) and stipends for STEM professionals seeking to become teachers. Support is also provided for summer internships for freshmen and sophomore students to provide early field experiences in formal and informal STEM education settings that will spark an interest in teaching. (NSF, 2008, p. 6)

With the goal of recruiting those who might not otherwise consider teaching, the Robert Noyce Teacher Scholarship program provides $10,000 annual scholarships for STEM majors who major in a STEM discipline and will obtain teacher licensure, and $10,000 annual stipends for STEM professionals who will obtain teacher licensure. The scholars and stipend recipients commit to teaching in a high-need school district for two years for each year of scholarship or stipend they receive; failure to fulfill the teaching obligation turns the scholarship into a loan. Summer internships, limited to $450 per week, are intended to introduce underclassmen to early experiences in formal and informal STEM education (NSF, 2008). To receive NSF funding through the Robert Noyce Teacher Scholarship program, eligible institutions of higher education (community colleges, colleges, and universities) must provide evidence of (a) exemplary teacher preparation effort, (b) functioning partnerships with local school districts, (c) a means of supporting new teachers, (d) an evaluation plan for gauging program effectiveness, and (e) cooperation with NSF third-party monitoring and evaluation (NSF, 2008, p. 9). Proposals for the Robert Noyce Teacher Scholarship program are reviewed with regard to intellectual merit and broader impacts.

In their study of the personal perceptions, characteristics, and teacher preparation program variables that influence Robert Noyce Teacher Scholarship participants' perceptions of the program, Pey-Yan Liou and Frances Lawrenz (2011) use multilevel modeling to examine "(1) what variables influence scholars' perceptions of the influence of the Noyce funding on their decision to become teachers and (2) the influence of the Noyce funding on their decisions to become teachers in high-need schools" (p. 131). Based on survey data from 427 Noyce scholars and 37 program principal investigators (PIs), Liou and Lawrenz (2011) determine that the level of Noyce funding (i.e., the percentage of tuition covered by the Noyce scholarship) was positively related to scholars' perceptions of the influence of the Noyce scholarship on becoming teachers while preparation for high-need schools had a negative effect. This suggests that "the greater the degree of exposure to curricula and activities that prepared preservice teachers for high-need schools, the less the Noyce program influenced scholars' decisions to become teachers" (Liou & Lawrenz, 2011, p. 135). With regard to whether Noyce scholars would have become teachers without receiving the Noyce scholarship, Liou and Lawrenz find a positive relationship, after controlling for program level predictors: "Noyce funding at the program level seemed to have a positive relationship with scholars' perception of the Noyce funding for them to become teachers, since scholars would not have become teachers if they had not received the Noyce funding" (2011, p.

135). Additionally, Liou and Lawrenz find a positive relationship between the Noyce funding and the scholars' becoming teachers in high-need schools: "Scholars in teacher preparation/certification programs with more preparation for high-need schools tended to have higher perceptions of the influence of the Noyce funding on becoming teachers in high-need schools" (2011, p. 137). Related to this, race had a negative relationship on whether scholars would become teachers at high-need schools without Noyce funding as non-White scholars had a greater perception of the influence of the Noyce funding on their decisions to teach in high-need schools.

Overall, the financial incentives of the Robert Noyce Scholarship program are not viewed as highly influential; only 3.5% of participating scholars said they would not have become teachers without the Noyce funding. Therefore, "scholars' personal characteristics and perceptions explain more of the variance in their perceptions of the influence of the Noyce funding on them becoming teachers than the characteristics of their teacher preparation/certification programs" (Liou & Lawrenz, 2011, p. 139). Concerning teaching in high-need schools, however, the financial incentives are somewhat influential: "More recipients are influenced by funding to teach in high-need schools than are influenced to teach" (Liou & Lawrenz, 2011, p. 139). Similarly, Pey-Yan Liou, Allison Kirchhoff, and Frances Lawrenz (2010) consider scholars' perceptions of the influence of the Robert Noyce Scholarship program on their (a) commitment to teaching, and (b) teaching in high-need schools. Based on the Noyce Scholarship Program Evaluation: Scholar Survey responses of 555 scholars, Liou and colleagues find that "scholars perceived the influence of the program in two ways; as a means to complete their teacher education program and as a means to become teachers in high need school" (p. 465). Overall, Liou et al. conclude,

> it seems that the scholarship program is perceived as being more related to finishing a certification program, than to participants' decision to become a teacher. Additionally, the scholarship program is perceived to be more related to the initial decision to teach in a high need school, but less related to remaining in that particular setting. (p. 468)

Relevance to my study. Though loan forgiveness programs such as the Robert Noyce Teacher Scholarship program seem logical, Liou and Lawrenz (2011) and Liou et al. (2010) highlight that there is little research on the effectiveness of such programs or the factors that contribute to their success. Additionally, there is little research on the induction supports provided to beginning STEM teachers through Robert Noyce Teacher Scholarship programs. Since two participants in this study are Noyce scholars, I initially thought receiving Noyce support during the first year of teaching would be an interesting point of contrast among my participants. I approached this study interested in learning more about the ways, if any, in which my participants drew on the Noyce supports they were provided. As will become clear in the results, neither Noyce scholar formally nor regularly drew on their Noyce supports. This finding, as I will argue, highlights that more research is needed into what aspects of Noyce and the induction support it offers have the potential to positively impact and support beginning secondary science teachers in science-focused ways.

Research on Science Teacher Induction

Issues of science teacher induction, support, and retention have been explored primarily by focusing on the individual teacher and the impact of induction programs on her beliefs and practices about science and science teaching (Luft et al., 2003, 2007; Luft & Patterson, 2002; Roehrig & Luft, 2006). Recognizing the vital importance of supporting beginning science teachers during their induction years, Luft and Patterson (2002) identify three premises for the development of induction programs for beginning science teachers, including long-term induction programs that are essential for the socialization of beginning science teachers, the need for support programs that address beliefs and practices specific to science and science teaching, and collaboration between the university, school district, and experienced teachers. As Alsup (2006) establishes, "if pre-service teachers are to become successful, self-actualized teachers, they require guidance and support from [school-based] mentors and [university-based] teacher educators as they transition into their careers" (p. 192). For Luft and Patterson (2002), these premises translate into the science-focused Alternative Support for Induction Science Teachers (ASIST) program at the University of Arizona, which aims to bridge the gap between pre-service experiences and inservice opportunities for beginning science teachers (Luft & Patterson, 2002). Offering the ASIST program as a science-focused induction opportunity for beginning science teachers, Luft et al. (2003) contrast the impacts of no induction, general induction, and science-focused induction programs on the teaching beliefs, instructional practices, and experiences of beginning science teachers, illustrating that beginning science teachers in a science-focused induction program are more likely to incorporate inquiry into their instruction while those in general induction programs or no induction program tend toward teacher-centered activities.

While it is established that beginning science teachers benefit from science-focused induction programs (Luft et al., 2003, 2007; Luft & Patterson, 2002; Roehrig & Luft, 2006), traditionally licensed teachers are not the only ones served by or who can benefit from quality induction programs. Roehrig and Luft (2006) additionally explore the ways in which science-focused induction programs, such as ASIST, address the beliefs and instructional needs of beginning science teachers with different preparation backgrounds, such as master of education with science emphasis, undergraduate K-8, undergraduate 7-12, and alternative certification, revealing that induction programs specifically designed to meet the needs of beginning science teachers can provide support to teachers in a variety of ways regardless of their preparation background.

As these studies contribute significantly to our understanding of science teacher induction, the science-focused ASIST program developed by Luft and her colleagues (Luft et al., 2003, 2007; Luft & Patterson, 2002; Roehrig & Luft, 2006) represents a best-case scenario for the induction of beginning secondary science teachers. In more rough-and-tumble, everyday situations, how might induction experiences impact beginning secondary science teachers? As discussed above, Ingersoll (2006) highlights the strong link between participation in an induction program and the likelihood of teacher migration or attrition after the first year: Turnover rate for teachers participating in no induction was 41%; it was reduced to 27% for teachers participating in basic induction;

for teachers receiving full induction turnover rate was less than half that of teacher receiving no support. Generally agreed upon components of successful induction were also previously discussed.

As this literature has significantly increased our understanding of induction programs for beginning teachers in general and beginning science teachers specifically, it is accompanied by the assumption that good, formal induction unequivocally translates to teacher retention. However, such a relation is not necessarily unidirectional, with much beyond a formalized program impacting the induction experiences of beginning teachers. To understand the meanings beginning science teachers make of their induction experiences, and whether and in what ways their identities might be shaped by these induction experiences necessitates a situated perspective for studying science teacher induction.

Conceptual Framework

Situated Learning Perspective

In valuing the multiple meanings beginning science teachers ascribe to their induction experiences, I conducted this study using an interpretive framework. As Thomas Schram (2006) highlights, an interpretive framework entails the following assumptions: People's knowledge and reality are constructed through interactions with others; any particular reality can only be understood from the point of view of those who live it; and a focus "on particular people, in particular places, at particular times" (p. 44) should be maintained. These assumptions impact the study of teacher induction in the following ways: The beginning teacher's knowledge and reality are constructed through interactions with others—their mentors, colleagues, induction coaches, administrators, students, and parent—and this situated nature of knowledge and reality construction should be acknowledged. The reality of beginning teachers can only be understood from their perspective, through talking with and privileging their voices about their experiences. Given this, my research focus is the beginning secondary science teachers, the ways they experience induction, and the meanings they ascribe to their induction supports. One way of applying this interpretive framework is through a situated learning perspective.

By shifting our understanding of learning from individual behaviors and cognition to participation in a group with the negotiation of in-group, or taken-for-granted, meanings (Greeno, 1998; Lave & Wenger, 1991; Wenger, 1998), learning becomes cast as both a social and cultural process. Learning, therefore, occurs in social situations with others using culturally constituted tools (books, symbols, artifacts, semiotic tools, etc.) within culturally constituted contexts (Claxton, 2002). Such participation, then, provides the context for learning as well as inducts participants into a group's culture (Wells & Claxton, 2002). Taken-for-granted norms, rules, and behaviors are components of that group culture. With regard to beginning science teachers, the "what or how to teach" oftentimes represents such taken-for-granted norms, rules, and behaviors that are needed to "make it" in the profession and be considered a successful teacher. How, then, do beginning science teachers gain access to this guidance and these taken-for-granted meanings?

As recognized by Etienne Wenger (1998), "it is members—by their participation—who create the set of possibilities to which newcomers are exposed as they negotiate their own trajectories" (p. 156). Through trajectories of participation, as beginning science teachers engage in the practices of the group, they constantly negotiate the meanings of their experiences (Wenger, 1998). As such, beginning science teachers can "produce meanings that extend, redirect, dismiss, reinterpret, modify or confirm . . . the histories of meanings of which they are part" (Wenger, 1998, pp. 52–53). The meanings, therefore, that beginning science teachers negotiate of being a successful science teacher have implications for their learning and development as professionals. Thus it is important to understand the meanings beginning science teachers make of their induction experiences as an ongoing accomplishment of their trajectory of participation. By developing a rich description of the meanings beginning science teachers make of their induction experiences, science educators, administrators, and school personnel will have a better understanding of which core components of induction programs are ascribed significance by beginning science teachers. This understanding of supports that are and are not meaningful to beginning science teachers will enable us to further develop beneficial supports while reconceptualizing those that beginning science teachers find less meaningful and valuable.

Identity

The work of developing an understanding of beginning science teachers' successful induction experiences, however, does not conclude with a picture of their meaning making. Beginning science teachers' meaning making in practice sends messages about who they need to and are expected to be. As beginning science teachers start to make sense of and negotiate the meanings of their experiences, they in turn begin performing their identities-in-practice. Stanton Wortham (2006), for example, maintains that learning through participation in practice "changes not just what and how the learner knows . . . but also who the learner is. To learn is to take up a new practice, to change one's position . . ., and thus it changes the self" (p. 141).

According to Wenger (1998), the identity component of a situated learning perspective constitutes "learning as becoming," focused on "a way of talking about how learning changes who we are" (p. 5). Such identity-in-practice "translates into a perspective" and "manifests as a tendency to come up with certain interpretations, to engage in certain actions, to make certain choices, to value certain experiences—all by virtue of participating in certain enterprises" (Wenger, 1998, p. 153). Through participation, identities give rise to trajectories, and it is by means of trajectories of participation that "identities incorporate the past and the future in the very process of negotiating the present" (Wenger, 1998, p. 155). Trajectories, then, provide a context for negotiation; they determine what we attend to and what we do not, what we deem significant and what we overlook. As Wenger (1998) maintains, "different trajectories give . . . very different perspectives on . . . participation and identities" (p. 155).

Of significance to the induction of beginning science teachers, paradigmatic trajectories, for example, "provide a set of models for negotiating trajectories" and are "likely to be the most influential factor shaping the learning of newcomers" (Wenger, 1998, p. 156). According to Wenger (1998), "any community of practice provides a set of models for negotiating trajectories . . . [that] embody the history of the community through the very participation and identities of practitioners" (p. 156). Induction programs and experiences may serve to provide this field of paradigmatic trajectories to beginning science teachers. Formal induction programs, for example, may promote specific ways of being a new teacher, a science teacher, or a teacher in a particular school or district. However, despite the meanings that are promoted in formal induction programs, once beginning science teachers "have actual access to the practice, they soon find out what counts" (Wenger, 1998, p. 156). Through negotiation, beginning science teachers must find their own unique identities and may "also provide models for different ways of participating" within trajectories (Wenger, 1998, p. 156).

Wenger's modes of belonging. According to Wenger (1998), identity formation and learning occur through distinct modes of belonging: engagement, imagination, and alignment. Engagement "affords the power to negotiate our enterprises and thus to shape the context in which we construct and experience identity" (p. 175); however, engagement can likewise become a barrier to learning and identity formation when it serves to sustain identities that are closed to other perspectives. For engagement to be a source of identity for beginning science teachers, they must have access to the full range of practices, which entails "access to and interaction with other participants . . . [and] the ability and the legitimacy to make contributions to the pursuit of an enterprise, to the negotiation of meaning, and to the development of a shared practice" (p. 184). Through engagement, beginning science teachers invest not only in their practice, but also in their relations with others.

Engagement provides resources for imagination, which allows us to uniquely experience the world and our place within it. Wenger (1998) describes that "through imagination, we can locate ourselves in the world and in history, and include in our identities other meanings, other possibilities, other perspectives" (p. 178). Including other meanings, possibilities, and perspectives in our identities requires exploration, risk-taking, and creativity as we "reinvent ourselves . . . [and] our practices" (Wenger, 1998, p. 185). Imagination, through building a picture of the world and locating ourselves within it, serves to determine how we make sense of and understand the practices in which we engage. Imagination, as related to beginning secondary science teachers, involves the visions they have for themselves as teachers in general and science teachers specifically—how do beginning teachers see and locate themselves in the teaching profession.

Connecting ourselves and our practices with those of others "through the coordination of [our] energies, actions, and practices" constitutes alignment (Wenger, 1998, p. 179). Such alignment with a broader enterprise requires the capacity to organize various perspectives and actions toward a common purpose. As a result of alignment, "the identity and enterprise of large groups can become parts of the identities of participants" (Wenger, 1998, p. 195). Alignment, as related to beginning secondary science teachers, might involve the coordination of their actions and teaching practices with those of their colleagues and/or the implied paradigmatic trajectory of the induction program.

Wenger's (1998) modes of belonging enable science educators, administrators, and school personnel not only to develop an understanding of the meanings beginning science teachers make of their induction experiences, but also to understand the perspectives and identities-in-practice that beginning science teachers develop from their experiences. For, as Wenger (1998) discusses, "the perspectives we bring to our endeavors are important because they shape both what we perceive and what we do" (p. 225).

Summary of Chapter II

In this chapter, I described literature on beginning teacher induction and support generally and beginning science teacher induction and support specifically. I also discussed the situated perspective on identity that frames my study. This conceptual framework is compelling because of the significant amount of identity work that occurs during this transition time. Additionally, adopting an interpretivist lens enables me to privilege the beginning science teachers' voices and experiences. Though there is research on beginning science teacher induction and support, foregrounding the ways in which beginning science teachers experience induction, the meanings they make of their induction experiences, and the identities they enact while participating in their induction and classroom science teaching provides an understanding that enables us to know whether and what aspects of induction programs and supports for beginning science teachers are successful.

In the next chapter, I discuss my qualitative research design, including participant selection, data collection, data analysis, validity, and ethics. With a commitment to accurately representing the participants' experiences and meanings, these case studies are conducted from an interpretive lens.

CHAPTER III

METHODOLOGY

In Chapter II, I argued that the meanings beginning secondary science teachers make of their induction supports as well as the identities-in-practice they develop as a result of engaging these supports can serve as qualitative indicators of successful induction experiences. Through their participation in induction experiences, beginning secondary science teachers negotiate the meanings of their experiences and begin conceptualizing their identities-in-practice (Wenger, 1998). As Wenger (1998) establishes, “we project our meanings into the world and then we perceive them as existing in the world, as having a reality of their own” (p. 58). Therefore, engagement is necessary for meaning making, while meanings impact the practices of beginning secondary science teachers and are developed in practice. Though beginning secondary science teachers negotiate meaning during routine activities, “[negotiation of meaning] is all the more true when we are involved in activities that we care about or that present us with challenges” (Wenger, 1998, p. 53)—activities that encompass what it is to be a beginning secondary science teacher.

Given this theoretical perspective, the purpose of this study was to examine the meaning making and identities-in-practice of beginning secondary science teachers as they engaged in various induction experiences. Toward this end, I aimed to describe the ways in which four beginning secondary science teachers in a local school district experienced their induction.

Below are the research questions that guided this study on the meaning-making and identities-in-practice of beginning secondary science teachers.

Primary Research Question #1:

How do beginning secondary science teachers experience induction?

Sub-questions:

a. What meanings do beginning secondary science teachers make of their induction experiences?
b. What meanings of "science teacher" are implied by their induction experiences? In other words, what are the identify affordances of their induction experiences and supports?
c. What identities-in-practice do beginning secondary science teachers enact during their induction experiences?

Primary Research Question #2:

What identities-in-practice do beginning secondary science teachers enact during their classroom science teaching?

Qualitative Research Design

This case study (Merriam, 2001) described the meanings beginning secondary science teachers made of their induction experiences and the identities they developed through their participation in induction experiences. I explored four (4) beginning secondary science teachers' identities-in-practice and meaning making during various induction supports—(a) induction activities such as content-focused seminars, (b) beginning teacher meetings, (c) PLC, and (d) mentor/mentee meetings—and their classroom science teaching. I originally designed the study to compare the experiences, identities-in-practice, and meaning-making of Noyce and non-Noyce teachers; however, that was not a relevant point of contrast between participants. As Merriam (2001) explains, "The case study offers a means of investigating complex social units consisting of multiple variables of potential importance in understanding the phenomenon. Anchored in real-life situations, the case study results in a rich and holistic account of a phenomenon" (p. 41).

Defining the Object of Study

Though there are various definitions of 'case study,' Merriam explains "the single most defining characteristic of case study research lies in delimiting the object of study, the case" (p. 27). The induction and support of four beginning secondary science teachers was a practical problem arising from everyday practice; therefore, this descriptive multi-case study of four beginning secondary science teachers' induction experiences aligned with Merriam's (2001) characterizations of case study in the following ways: It focused on the practical and important phenomenon of beginning secondary science teachers' induction experiences; resulted in a rich, thick description of district-sanctioned, Noyce-supported, and other, less formal induction supports; and illuminated readers' understandings of beginning secondary science teachers' induction supports, meaning making, and identities-in-practice. In focusing on the induction experiences of beginning secondary science teachers, the meanings they made of those experiences, and their identities-in-practice, I defined the cases in this study as the beginning secondary science teachers themselves. Therefore, there were four individual cases with the beginning secondary science teacher as the unit of analysis. With the teacher as the unit of analysis, I conducted cross-case analysis to see if there were patterns of experience or identities-in-practice among the four teachers.

Types of Case Studies

Merriam (2001) also discusses types of case studies based on the disciplinary orientations and overall intent of the case study: case studies can be ethnographic, historical, psychological, or sociological in disciplinary orientations; and descriptive, interpretive, or evaluative in overall intent. In focusing on the socialization, or enculturation, of beginning secondary science teachers into the profession, these case studies were sociological in their disciplinary orientations. Citing Hamel (1993), Merriam (2001) draws attention to the fact that "'as a sociological approach, the case study strives to highlight the features or attributes of social life. This is true whether the latter is perceived as a set of interactions, as common behavior patterns, or as structures' (p. 2)" (p. 37). By describing the meanings of "science teacher" implied by district-sanctioned, Noyce-supported, and other, less formal induction supports, aspects of the case studies were also ethnographic in their disciplinary orientations. Additionally, the intent to "[present] a detailed account of the phenomenon under study" (Merriam, 2001, p. 38) was descriptive in nature.

Site of Research

Though retention statistics indicate whether beginning secondary science teachers' induction was successful in keeping them in the classroom, these qualitative case studies described the nature of induction supports and illuminated the meanings beginning secondary science teachers made of their induction supports as well as the ways in which the negotiated meanings of those experiences shaped their identities-in-practice. Such information can provide a richer description and understanding of the induction experiences of beginning secondary science teachers.

A local school district served as the research site because it had a formal, routinely implemented, school district-developed teacher induction program that included sessions in the summer before the start of the school year, continued beginning teacher meetings throughout the year, and designated mentor/mentee components, among other supports. This provided the context for beginning secondary science teachers to have access to a variety of induction supports. The proximity of the local school district allowed me to be more involved with the participants, having the opportunity to observe more of the induction activities and programs in which the beginning teachers participated.

Research Context

The beginning secondary science teachers in this study were provided support at various levels: district-level, school-based, and additional district-sanctioned professional development activities. District-level supports included orientation and assigned induction and success coaches. School-based supports included mentors, beginning teacher meetings, colleagues, professional learning communities, and administration. Additional district-sanctioned supports included district content-focused seminars and online instructional resources as well as additional professional development. Two of my four participates were also supported by their university's Noyce Program. Next, I describe the state's beginning teacher support policies that formed the foundation for the district's induction program.

Overview of North Carolina's Beginning Teacher Support Program. Since all four of the beginning secondary science teachers in my dissertation study taught in the same school district, the district and schools were expected to follow the same state support program for beginning teachers. Presently, all teachers in North Carolina who hold an initial teaching license are required to participate in a three-year induction program that includes a formal orientation, mentor support, observations, and formative and summative evaluations before they can be recommended for a continuing teaching license (North Carolina State Board of Education, 2010). The required formal orientation is expected to be conducted prior to the arrival of students and should

> provide the beginning teacher with an overview of the school's/system's goals, policies, and procedures; a description of available services and training opportunities; the Beginning Teacher Support Program and the process for achieving a Standard Professional 2 (continuing) license; the North Carolina Teacher Evaluation Process; the NC Standard Course of Study; local curriculum guides; the safe and appropriate use of seclusion and restraint of students; the State's ABC's Program; and the State Board of Education's Missions and Goals. (pp. 2–3)

As part of the Beginning Teacher Support Program, it is expected that beginning teachers be assigned a mentor teacher in their area of licensure. This mentor is to be qualified and well-trained, demonstrating successful teaching in the area of licensure, commitment to mentoring and professional development, and completion of a mentor training program. Mentor training and support is the school system's responsibility and is expected to align with the state's Standards for Mentor Training. In collaboration with her mentor and administrator, the beginning teacher is required to develop a Professional Development Plan that aims at improving her professional skills based on the North Carolina Professional Teaching Standards. Beginning teachers are also expected to be observed at least three times a year by an administrator and one time a year by a fellow teacher. Post-conferences are expected to follow these observations. The mentor teacher's role in the observations must be specified in the school system's Beginning Teacher Support Program Plan. Furthermore, the following working conditions are strongly recommended for beginning teachers:

> assignment in the area of licensure; mentor assigned early, in the licensure area, and in close proximity; orientation that includes state, district, and school expectations; limited preparations; limited non-instructional duties; limited number of exceptional or difficult students; and no extracurricular assignments unless requested in writing by the beginning teacher. (p. 2)

The school system is responsible for developing and providing a comprehensive program for beginning teachers that encompasses the aspects described above. Additionally, each school system must submit an annual report on its Beginning Teacher Support Program. According to the North Carolina State Board of Education's (2010) beginning teacher support policies, in the first year,

> the beginning teacher: is assigned a mentor; is provided an orientation; develops a Professional Development Plan; completes any professional development required/prescribed by the LEA; is observed at least four times culminating with a summative evaluation. (p. 3)

Based on these policies, the school district provided beginning teachers with the following supports: district orientation, and induction and success coaches. Beginning teachers' mentors, monthly beginning teacher meetings, and school induction coordinators, though mandated by the school district, were more school-based forms of support.

District orientation, and induction and success coaches. Initial support for the beginning secondary science teachers was offered prior to the start of the school year in the form of district orientation. As the Director of Induction and Professional Development explained, "[orientation] is a 3-day program and the state does require that you offer a 3-day [orientation] program to all teachers that are have less than 6 months experience" (interview, 10/21/2010). The first day of orientation focused on policies and procedures for the school district: In the morning, beginning teachers attended seminars on professionalism, character development, and diversity, and met their induction and success coaches; in the afternoon, they visited model classrooms and learned about preparing for the first day of school. On day two, the beginning teachers returned to the model classroom for a day focused on curriculum. The district's curriculum specialists overviewed the district's online instructional resources, pacing guides, and the state curricula for beginning teachers. On the final day of district orientation, beginning teachers attended a two and a half hour session on classroom management. They also learned about the state's new teacher evaluation system and heard a panel of new teachers discuss their first-year experiences.[1]

At the end of district orientation, the Director of Induction and Professional Development intended for the beginning teachers to be aware of the support system in place to help them: Beginning teachers had their induction and success coaches, mentors, and school administrators. Of these supports, their only truly confidential relationship was with their induction and success coach (interview, 10/21/2010). This sentiment was echoed by one participant's induction and success coach: She wanted beginning teachers to recognize that she was there for them as a "totally confidential" support (interview, 9/30/2010).

School-based supports. The beginning secondary science teachers received school-based induction supports in the form of mentors, monthly beginning teacher meetings, and their induction coordinators. Evident in Chapter IV, the enactment of these supports varied across contexts. Below, I describe the school-based supports to which my participants had access.

Mentors. As previously discussed, the state's beginning teacher support policies require that each new teacher be assigned a qualified, well-trained mentor, recommending also that the mentor be in the new teacher's licensure area. Each beginning secondary science teacher was expected to meet with her mentor thirty minutes per week. During the mentor/mentee meetings, mentors were expected to support beginning teachers to

[1] These descriptions of district orientation were based on an interview with the district's Director of Induction and Professional Development (10/21/2010).

> demonstrate leadership . . . establish a respectful environment for a diverse population of students . . . know the content they teach . . . facilitate learning for their students . . . [and] reflect on their practice. (North Carolina State Board of Education, 2010, p. 11)

Beginning teacher meetings. In addition to their mentors, the beginning secondary science teachers also received school-based support in the forms of beginning teacher meetings and their schools' induction coordinators. In accordance with the state's beginning teacher support policies, the school district expected the schools' induction coordinator to plan and conduct monthly beginning teacher meetings for the new teachers at their schools. As the district's Director of Induction and Professional Development explained,

> [The new teachers] have monthly meetings that they have to go to . . . [T]hey are done by the [school's] induction coordinator . . . So something that we struggle with as a department is, those seminars are only as strong as the induction coordinator . . . They're a classroom teacher. They're a teacher. This is just an extra job for them while we pay them $500 for the year to do these [beginning teacher meetings]. (interview, 10/21/2011)

As the Director of Induction and Professional Development highlighted, the monthly beginning teacher meetings frequently differed from school to school based on the school's induction coordinator.

Content-focused seminars and online resources. The district's content-focused seminars were held monthly and were open to all teachers within a specific science discipline, not only beginning teachers. For example, the earth/environmental science seminars were a professional development opportunity where earth/environmental science teachers from across the district could come together, regardless of experience, to share resources, lesson plans, and best practices. At the meetings, the science curriculum coordinators made general announcements pertinent to the science teachers, and selected teachers from across the school district presented teaching resources, activities, or strategies.

As the Director of Induction and Professional Development explained, the district's online instructional resources management system

> has all of our pacing guides on it. It has the [state curriculum]. It has lesson plans on it. [During orientation] they showed them (the beginning teachers) all of that information. Umm, they took them to the computer lab, gave them time to do that. They talked about lesson planning, talked about just because the lesson plan is [in the system] doesn't mean that it is appropriate for your classroom. You need to adapt it for your classroom (interview, 10/21/2010).

Robert Noyce Teacher Scholarship Program. In addition to the district-level and school-based supports previously discussed, two of the four beginning secondary science teachers received supports from their university's Robert Noyce Teacher Scholarship Program.

For Jessica and Whitney, these supports included access to university mentors in the beginning secondary science teachers' content areas (e.g., chemistry, biology, physics, etc.) and in science education; support with instructional resources and teaching ideas; personal face-to-face, email, or telephone contact; and meetings centered on Noyce teachers' concerns and needs. During their time as Noyce scholars at the university, the Noyce teachers built professional relationships with university faculty in science and science education through completing internships and participating in cohort activities led by faculty members. These faculty members continued serve as potential resources for the Noyce teachers during their induction years. Additionally, the project coordinator, a role I occupied at the time of this study, provided the Noyce teachers with instructional support including resources and teaching ideas. This support was provided several ways. If an instructional need was communicated over the telephone, via email, or face-to-face, I typically sent an email which included relevant teaching resources and materials. I also highlighted instructional resources as well as professional development opportunities in our monthly newsletter, and provided a list of teaching resources on our cohort website. For some expressed concerns, I arranged face-to-face meetings. For example, I coordinated a resource exchange for earth and environmental science (11/10/2010). Additionally, I assisted Noyce teachers in their classrooms as requested. In coordinating the Noyce support provided to beginning secondary science teachers, I aimed to be responsive to their needs and flexible in terms of the ways in which support was provided. As project coordinator, I had a previous relationship with the Noyce teachers: I coordinated the cohort activities in which they participated during their summer internships and during the academic year in which they received scholarship funding. Additionally, I taught their secondary science methods course and supervised their student teaching experiences.

Beginning secondary science teachers who engaged district-level, school-based, and/or Noyce supports were afforded other less formal types of induction support. Other less formal types of induction support included, for example, walking across the hall to a colleague’s classroom, hallway conversations with other teachers, classroom interactions with students, and interactions with parents. Describing and examining the ways in which four beginning secondary science teachers experienced their induction supports allowed me to develop a comprehensive understanding of how the beginning secondary science teachers were supported as well as what meanings they made of their induction supports. Though my four participants taught in the same school system, the various induction supports described above were differentially enacted across contexts. Given this, I conducted with-in case and cross-case analyses of participants' induction experiences.

Participants and Participant Selection

As Creswell (2005) explains, a case study is "a case analysis of a person, event, activity, or process set within a cultural perspective" (p. 438). For the purposes of this study, the cases studied were four beginning secondary science teachers in the local school district. Beginning with a conceptual framework that elucidates how and why beginning secondary science teachers' participation in induction experiences influences their meaning-making and their identities-in-practice, participants ultimately included four beginning secondary science teachers—two who participated in the district-sanctioned induction supports and two who participated in the district-sanctioned experiences along with Noyce-supported experiences—who actively engaged in the induction activities and experiences available to them. This necessitated selecting participants who attended the school- and district-planned induction activities and regularly interacted with their mentors and others in their departments.

Participant Recruitment

I aimed to recruit participants who had attended the school district's orientation prior to the start of school, and who regularly engaged in the other induction supports provided to them. To recruit participants, I initially took the following steps: The school district's secondary science coordinator forwarded an email about me and my dissertation research to the district's fifteen beginning secondary science teachers. This recruitment strategy yielded one participant, Sophia.

At the start of the academic year (mid- to late-August) I also looked at school websites in an attempt to identify beginning secondary science teachers; most of the schools' websites, however, were not updated from the previous academic year. Additionally, within the first month of school I made personal, face-to-face contact with four beginning secondary science teachers at two high schools: One did not continue contact with me after our initial conversation, one was no longer teaching at the time I recruited participants, one was planned to leave teaching in December, and one was interested in but hesitant about participating.

At the end of September when I interviewed the district's secondary science coordinator for this study, she recommended two beginning secondary science teachers whom she felt would make good participants in the study. I emailed the teachers she recommended; this recruitment strategy yielded one more participant, Ingrid. Additionally, the secondary science coordinator offered to mention my dissertation study to two beginning secondary science teachers at a high school where she conducted the weekly curriculum planning/PLC meetings. Neither of these teachers expressed interest in participating in this study.

I then added a monetary incentive of twenty dollars per hour for the initial interview and three follow-up interviews as a way to alleviate recruitment concerns.

Additionally in October, I broadened my participant selection criteria to recruit Noyce teachers from the university's Robert Noyce Teacher Scholarship Program[2]. Still maintaining my selection criteria and the expectation that my participants participated in the district's orientation program, this strategy yielded two more participants, Jessica and Whitney. The four beginning secondary science teachers who were successfully recruited to participate in this study taught at different high schools within the district. The characteristics of these participating teachers are summarized in Table 1.

The purposeful sampling I employed was both opportunistic (Miles & Huberman, 1994) and convenient (Merriam, 2001; Miles & Huberman, 1994). However, I maintained my participant selection criterion: The beginning secondary science teachers in this study participated in the formal, district orientation and continued to engage in the various induction supports provided them throughout the school year. Looking at numerous ways these beginning secondary science teachers were supported resulted in information-rich cases that enabled me to learn a great deal about the induction experiences of beginning secondary science teachers (Merriam, 2001) while illuminating differences between teaching contexts and induction experiences on beginning secondary science teachers' meaning making and identities-in-practice (Maxwell, 2005).

[2] To avoid any potential conflicts of interest, I initially did not recruit the university's Noyce teachers. Doing this immediately eliminated three potential participants from the already small pool of beginning secondary science teachers in the district. Through transparency of the research problem and methods, conflicts of interest were mitigated, and two Noyce teachers were recruited to participate in this study.

Table 1. Characteristics of Beginning Secondary Science Teacher Participants

Participant	Teacher Preparation	Content Major	Type of School[a]	School Schedule	Courses Taught
Sophia	Undergraduate teacher preparation at a large, 4-year public university in Southeast U.S.	Biology	School of Distinction	Traditional schedule	Earth/Environmental Honors Earth/Environmental
Ingrid	Undergraduate teacher preparation at a large, 4-year public university in Southeast U.S.	Biology	Priority School	Block schedule	1st semester: Biology 2nd semester: Earth/Environmental
Jessica	Graduate teacher preparation at a large, 4-year public university in Southeast U.S.	Biochemistry	School of Progress	Block schedule	1st semester: Chemistry Honors Chemistry Earth/Environmental 2nd semester: Chemistry
Whitney	Undergraduate teacher preparation at a large, 4-year public university in Southeast U.S.	Biology	School of Progress	Block schedule	1st semester: Earth/Environmental Honors Earth/Environmental 2nd semester: Earth/Environmental Honors Biology

[a] According to the schools' 2009-2010 North Carolina School Report Cards.

Methods of Data Collection

I used qualitative methods in this study to develop in-depth and rich descriptions of the meanings beginning secondary science teachers made of their induction experiences as well as the identities-in-practice they enacted through participation in these experiences (see Appendix A for an overview of the study design). I primarily collected data through interviews with the beginning secondary science teachers and school and/or district personnel who planned and conducted induction activities; along with observations of induction activities, mentor/mentee meetings, curriculum planning/PLC meetings, and classroom science teaching in which the beginning secondary science teachers engaged. I attended all possible formal induction activities in which the beginning secondary science teachers participated, interviewing the school and/or district personnel conducting the induction activities before the program and the beginning secondary science teachers afterward; and observed the beginning secondary science teachers' engagement in their induction activities, mentor/mentee meetings, curriculum planning/PLC meetings, and classroom teaching throughout the academic year.

I was unable to observe the beginning secondary science teachers' district orientation activities in mid-August because I had not yet obtained permission from my committee or the school system to begin this research study. I gathered information on these activities *ex post-facto* by interviewing the district personnel responsible for planning and conducting these orientation activities as well as the beginning secondary science teachers.

Interviews

To understand the meanings beginning secondary science teachers made of their induction experiences, I needed to clearly explain the programs and activities in which the beginning science teachers participated. I conducted audio-recorded interviews with school and district personnel who coordinated and conducted formal induction programs and activities (see Appendix B) to describe the induction experiences to which beginning secondary science teachers were exposed and to gain insight into the intent of the induction activities. To understand the meanings beginning secondary science teachers made of their induction experiences as well as their identities-in-practice from participating in induction activities, I interviewed each participant at least three times throughout the academic year. I conducted the initial interview (see Appendix C) within the same week the beginning teacher was recruited and gave consent. During these interviews, I aimed to understand beginning secondary science teachers' expectations of induction supports. Due to the delay in receiving permission for the research from the local school system, I was unable to conduct the initial interviews prior to the start of the school year. I conducted the initial interviews as close to the start of the school year as possible once permission was received; I conducted the remaining two follow-up interviews (see Appendix D) midway through the academic year and toward the end of the academic year. The initial and follow-up interviews were distributed over the course of the academic year to gain an understanding of the beginning secondary science teachers' trajectories of participation and identification (Wenger, 1998). Mid-year and end-of-year interviews were planned so as to not interfere with end-of-course exam preparation and testing. I interviewed the teachers at their home schools or over the phone and audio-taped the interviews for later transcription. In addition to these three primary interviews, I briefly interviewed beginning secondary science teachers following induction activities, curriculum planning/PLC meetings, and classroom observations to get their perspectives on these experiences. These brief interviews enabled me to understand the meanings beginning secondary science teachers made of their formal induction experiences and their identities-in-practice. I completed contact summary sheets following each interview with beginning secondary science teachers and school and/or district personnel (see Appendix I) (Miles & Huberman, 1994). Table 2 summarizes when each participant, including district and school personnel who supported the beginning secondary science teachers, was interviewed.

Observations

To support information gleaned from interviews and to better understand the experiences that comprised beginning secondary science teachers' induction and how they engaged in and applied or made use of those experiences, I conducted observations of the beginning secondary science teachers as they participated in induction activities (see Appendix E) and curriculum planning/PLC meetings (see Appendix F). I aimed to observe at least three induction activities and three curriculum planning/PLC meetings for each of the four beginning secondary science teachers; however, in most cases, this was not possible. (See Table 3 for a summary of the data I attempted to collect compared with the data I ultimately collected.) I wrote detailed field notes for each observation;

Table 2. Summary of Interview Data

	Interviews						
				Post-Observation			
Participants	**Initial**	**Follow-Up**	**Final**	**Induction Activity**	**Beginning Teacher Meeting**	**PLC**	**Classroom Teaching**
Sophia	9/28/2010	10/5/2010	5/31/2011	3/11/2011	3/21/2011	5/13/2011	3/18/2011 3/23/2011 3/28/2011 5/11/2011 5/13/2011
Sophia's Induction Coach	9/30/3010						
Ingrid	10/18/2010	1/11/2011	5/12/2011	2/22/2011		5/17/2011	12/15/2010[a] 2/21/2011 3/1/2011 5/2/2011 5/4/2011 5/6/2011 5/17/2011
Ingrid's Science Coach						5/30/2011	
Jessica	11/4/2010	3/2/2011	5/17/2011	[b]			3/16/2011 5/9/2011 5/12/2011
Jessica's Induction Coordinator					1/5/2011 4/14/2011		

Table 2 (cont.)

	Interviews						
				Post-Observation			
Participants	**Initial**	**Follow-up**	**Final**	**Induction Activity**	**Beginning Teacher Meeting**	**PLC**	**Classroom Teaching**
Whitney	11/8/2010	1/11/2011	5/16/2011	2/22/2011	11/30/2010	12/13/2010 5/6/2011	12/7/2010 12/8/2010 1/28/2011 2/1/2011 3/3/2011 4/28/2011 5/2/2011 5/6/2011 5/16/2011
Whitney's Induction Coordinator					11/30/2010		
Whitney's Curriculum Facilitator						5/5/2011	
District's Science Curriculum Specialist	9/29/2010						
District's Director of Induction and Professional Development	10/21/2010						

Note: The dates included here indicate the actual date of the interview. In some cases, post-observations occurred days after the observations. Likewise, some post-observation interviews discussed more than one observation.

[a] We conducted all of Ingrid's post-observation interviews concerning her science teacher via email.

[b] I was unable to observe Jessica's participation in additional induction activities outside of her beginning teacher meetings and mentor/mentee meetings.

Table 3. Summary of Data Collection

	Data Sources							
	Observations (with brief follow-up interviews)				Primary Interviews			
Participants	Induction Activities	PLC	Mentor/ Mentee	Classroom	Initial	Follow-Up	Final	Total Contacts
Beginning Secondary Science Teachers								
Sophia	5 attempts 2 contacts[a]	3 attempts 3 contact	2[b]	11 attempts 9 contacts	1	1	1	19
Ingrid	1[c]	4 attempts 2 contacts	3	10 attempts 9 contacts	1	1	1	18
Jessica	3 attempts 3 contacts	3 attempts 1 contact[d]	3	11 attempts 8 contacts	1	1	1	18
Whitney	2 attempts 2 contacts[e]	3 attempts 3 contacts	1[f]	9 attempts 9 contacts	1	1	1	18
School and District Personnel								
Sophia's Induction Coach					1 attempt 1 contact			1
Ingrid's Science Coach		2 attempts 1 contact						1
Jessica's Induction Coordinator	2 attempts 2 contacts							2

Table 3 (cont.)

	Data Sources							
	Observations (with brief follow-up interviews)				Primary Interviews			
Participants	Induction Activities	PLC	Mentor/ Mentee	Classroom	Initial	Follow-Up	Final	Total Contacts
Whitney's Induction Coordinator	1 attempt 1 contact							1
Whitney's Curriculum Facilitator		1 attempt 1 contact						1
Jessica's & Whitney's Induction Coach					2 attempts 0 contacts			0
District's Science Curriculum Specialist					1 attempt 1 contact			1
District's Director of Induction and Professional Development					1 attempt 1 contact			1
							Grand Total	81

Table 3 (cont.)

Note: In considering attempts at data collection, I counted the times that an observation was scheduled, but then was canceled. According to my proposed data collection plan (3 induction activity observations, 3 PLC observations, 3 mentor/mentee recordings, 9 classroom observations, 1 initial interview, 1 follow-up interview, and 1 final interview), I should have made a total 22 contacts for each participant.
[a] The induction activities I observed for Sophia consisted of 1 beginning teacher meeting and 1 content-focused district seminar.
[b] Sophia reported recording 3 mentor/mentee meetings; however, she only gave me audio recordings of 2.
[c] I observed Ingrid at a content-focused district seminar. The beginning teacher meetings at her school where irregularly scheduled and she was typically given short notice of these meetings, making it nearly impossible to observe them.
[d] Jessica's PLC meetings were school- rather than department-wide and were sometimes canceled to give priority to other school-wide happenings, such as blood drives.
[e] Whitney's induction coordinator did not hold any beginning teacher meetings during the second semester. One of these induction activities was the content-focused district seminar.
[f] This was the only formal meeting between Whitney and her mentor.

additionally, I completed contact summary sheets following each contact (Miles & Huberman, 1994).

Due to the impromptu nature of mentor/mentee meetings, I "observed" those meetings indirectly by asking each beginning science teacher audio to record at least three discussions between herself and her mentor. I transcribed participants' audio recorded mentor/mentee meetings, and wrote a contact summary sheet for each. I used an observation protocol (see Appendix G) when listening to and reading the recorded mentor/mentee discussions. I proposed to obtain three audio recorded mentor/mentee meetings for each participant. However, I received three audio recordings only from Ingrid and Jessica; Sophia and Whitney each submitted one. Similar to the follow-up interviews, observations of induction activities, curriculum planning/PLC meetings, and mentor/mentee meetings were, in most cases, distributed over the academic year in order to gain an understanding of the beginning secondary science teachers' participation throughout the school year (Wenger, 1998).

To gain further insight into the beginning secondary science teachers' identities-in-practice, I observed the beginning secondary science teachers' classroom science teaching (see Appendix H). I observed nine class periods each for Sophia, Ingrid, and Whitney; I observed Jessica's classroom science teaching eight times. To avoid the start and end of the semester—both hectic times for beginning teachers—the classroom teaching observations occurred toward mid-semester in the fall and spring. Like the interviews and previously discussed observations, I aimed to spread classroom teaching observations across the academic year in order to develop a robust depiction of the beginning secondary science teachers' identities-in-practice. Despite this aim, snow days, end-of-semester testing, and various events in the personal lives of my participants and at the schools prevented me equally dividing my observations across the school year. Most of my observations occurred during March and May. During the observations, my role was not to judge the instruction of the beginning secondary science teachers, but rather my aim was to understand their identities-in-practice while teaching as operationalized by Wenger's modes of belonging (Wenger, 1998). My continued contact with participants over the course of the school year opened up the potential for me to serve as a support for these beginning teachers. I accounted for this possibility in data analysis and in my list of start codes (see Appendix J). Following the observations, I briefly interviewed the beginning secondary science teachers about episodes that occur during the observation periods. I took detailed field notes during each observation and completed contact summary sheets following each observation. I summarize the observation data I collected for each participant in Table 4. Table 5 summarizes the planning that factored into my decisions about the types of data to collect for this study.

Table 4. Summary of Observation Data

	Observations				
Participants	**Induction Activity**	**Beginning Teacher Meeting**	**PLC**	**Mentor/Mentee Meeting**	**Classroom Teaching**
Sophia	2/21/2011	3/18/2011	3/23/2011 5/11/2011 5/18/2011	4/2011	12/14/2010 3/17/2011 3/21/2011 3/23/2011 3/28/2011 5/3/2011

Table 4 (cont.)

Participants	Induction Activity	Beginning Teacher Meeting	PLC	Mentor/Mentee Meeting	Classroom Teaching
	Observations				
Sophia (cont.)					5/9/2011 5/12/2011 5/13/2011
Ingrid	2/21/2011		2/23/2011 5/11/2011		12/13/2010 12/15/2010 2/17/2011 2/21/2011 3/1/2011 5/2/2011 5/4/2011 5/6/2011 5/10/2011
Jessica		1/5/2011 4/14/2011 5/5/2011	5/11/2011	4/4/2011 4/7/2011 5/5/2011	3/2/2011 3/4/2011 3/10/2011 3/18/2011 5/5/2011 5/9/2011 5/10/2011 5/12/2011
Whitney	2/21/2011	11/30/2010	12/9/2010 3/10/2011 5/5/2011	12/14/2010	12/7/2010 12/8/2010 1/28/2011 2/1/2011 3/3/2011 4/28/2011 5/2/2011 5/6/2011 5/16/2011

Table 5. Data-Planning Matrix

What do I need to know?	Why do I need to know this?	What kind of data will answer the questions?	How will I initially analyze this data?
What comprises the induction experiences of beginning secondary science teachers in typical, district-sanctioned induction, Noyce-supported induction, and other, less formal induction support?	To describe and understand induction program and activities in order to be able to explain the meanings beginning secondary science teachers make of these experiences To describe and understand the meanings of "science teacher" that are implied by these experiences	Interviews with school and district personnel who plan and conduct induction activities; Observation of induction activities; Interviews with beginning secondary science teachers (to gain understanding of informal induction experiences)	Contact summary sheets, coding (descriptive and interpretive), pattern coding, memos
How do beginning science teachers experience their induction—what meanings do they make of their experiences?	To be able to accurately and richly describe the meanings they ascribe to their induction. (For now, describing experiences will add to the literature on meanings beginning science teachers make of their induction; in the future these descriptions could provide insight for improving science teacher induction)	Interviews with beginning secondary science teachers three times throughout the semester; Observations of mentor/mentee meetings, and curriculum planning/PLC meetings	Contact summary sheets, coding (descriptive and interpretive), pattern coding, memos

Table 5 (cont.)

What do I need to know?	Why do I need to know this?	What kind of data will answer the questions?	How will I initially analyze this data?
What identities-in-practice do beginning secondary science teachers enact in their induction experiences?	To be able to richly describe the identities (based on Wenger's (1998) models of belonging—engagement, imagination, alignment) they develop from their participation in induction experiences. To illustrate their identification with promoted practices and identities	Interviews with beginning secondary science teachers; Observations of mentor/mentee meetings, and curriculum planning/PLC meetings	Contact summary sheets, coding (descriptive and interpretive), pattern coding, memos
What identities-in-practice do beginning secondary science teachers enact during their classroom science teaching?	To be able to richly describe the identities they enact during teaching	Interviews with beginning secondary science teachers; Observations of classroom science teaching	Contact summary sheets, coding (descriptive and interpretive), pattern coding, memos

Note. Adapted from Maxwell, 2005, p. 100.

Methods of Data Analysis

Based on Matthew Miles and Michael Huberman (1994), I used contact summary sheets to focus and summarize the data collected soon after each contact was made. Doing so allowed me to reflect upon the main ideas, themes, and questions that arose during the contact, and to preserve the details of the contact. I used a list of start codes to initially analyze data from interviews and observations (see Appendix I). These start codes were based on my conceptual framework, research questions, and a previous pilot study. I applied the list of start codes to initial sets of interview transcripts and field notes. Iterative with data collection, this helped me to make initial sense of my data. By using the start codes, I began to describe the induction activities of the beginning secondary science teachers. However, since the beginning secondary science teachers' induction experiences placed them within particular social situations, I needed a data analysis method that enabled me to describe and understand the cultural norms of these situations. I used James Spradley's (1980) methods of domain, taxonomic, and componential analysis to identify cultural themes among the induction experiences of my participants. Through domain analysis, I identified categories of cultural meaning (e.g., reasons for mentor's support). During taxonomic analysis, I looked for relationships among the included terms in a particular domain to reveal subsets and how those subsets were related to the domain as a whole (e.g., reasons for mentor's support included instructional, procedural, and emotional reasons, all of which were further broken down by types of instructional, procedural, and emotional reasons, respectively). Finally, componential analysis allowed me to compare categories for instances of contrast within and among domains (e.g., instructional, procedural, and emotional reasons for mentor's support were contrasted along dimensions of focus, initiation, and outcomes).

To begin domain analysis, I read through my interview transcripts and observation field notes looking for categories of cultural meaning, domains. Each domain was made up of a cover term, semantic relationship, and included terms. The cover term (e.g., topics covered during induction activities) was the name of the cultural domain, and the included terms (e.g., end-of-year procedures) were smaller categories within the domain. The semantic relationship served to link the cover term and included terms through a single relationship (e.g., end-of-year procedures *is a kind of* topic covered during induction activities). I used my conceptual framework, observation protocols, and list of start codes to initially guide my domain analysis; however, Spradley (1980) provides a list of universal semantic relationships researchers can use to begin domain analysis. See Table 6 for examples of how I used Spradley's (1980) list of universal semantic relationships for domain analysis. Domains that emerged during analysis also included kinds of supports, kinds of observation feedback, ways to plan instruction, ways to interact with colleagues, and results of interacting with mentors. Domain analysis resulted in the identification of 31 domains. I used *QSR NVivo 9* software to manage these domains and their subcategories.

Table 6. Examples of Semantic Relationships Used for Domain Analysis

Relationship	Form	Example
Strict Inclusion	X is a kind of Y	End-of-year procedures *is a kind of* topic covered during induction activities
Cause-effect	X is a result of Y	New ideas *is a result of* collaborative planning
Rationale	X is a reason for doing Y	Help with classroom discipline *is a reason for* seeking administrative support

Table 6 (cont.)

Relationship	Form	Example
Function	X is used for Y	Conversation with colleagues *is used for* venting frustrations
Means-end	X is a way to do Y	Listening to students' questions *is a way to* gauge the success of a lesson
Attribution	X is an attribution (characteristic) of Y	Informality *is a characteristics of* mentor/mentee meetings

Note: This table shows the semantic relationships that I used during domain analysis. Spradley suggests 9 different universal semantic relationships (1980, p. 93), 6 of which I used to analyze data for this study.

Based on Spradley's (1980) universal semantic relationships, Table 7 shows the domains I identified from my observation and interview data.

Table 7. Identified Domains

Relationship	Form	Resulting Domains
Strict Inclusion	X is a kind of Y	Kinds of interactions Kinds of supports Kinds of topics covered during induction activities Kinds of teacher roles during induction activities Kinds of teacher roles during classroom teaching Kinds of obstacles to realizing vision for classroom teaching
Cause-effect	X is a result of Y	Result of teacher preparation Results of collaborative planning/PLC Results of interacting with mentor Results of interacting with colleagues Results of interacting with administrators

Table 7 (cont.)

Relationship	Form	Resulting Domains
Rationale	X is a reason for doing Y	Reasons for mentor's supports Reasons for colleagues' support Reasons for administrators' support Reasons for attending PLC Reasons for attending content-focused seminars Reasons for revising lessons for future Reasons for viewing lessons as successful
Function	X is used for Y	Uses for instructional supports Uses for emotional supports
Means-end	X is a way to do Y	Ways to plan instruction Ways to interact with colleagues Ways to participate during induction activities Ways to modify lessons for future Ways to gauge success of science lessons
Attribution	X is an attribution (characteristic) of Y	Characteristics of mentor/mentee meetings Characteristics of beginning teacher meetings Characteristics of PLC meetings Characteristics of content-focused seminars Characteristics of induction activities Characteristics of classroom science teaching Characteristics of vision for science teaching

Following domain analysis, I used taxonomic analysis to look for relationships among the data in each domain. For example, "topics covered during induction activities" was broken down into the following subcategories: (a) topics covered by the school and/or district personnel conducting the activity, (b) topics taken up by the beginning secondary science teachers, and (c) questions asked by the beginning secondary science teachers. Breaking the domains into smaller subcategories sometimes resulted in moving subcategories, creating new domains, or collapsing two or more domains into one. For example, during domain analysis, I initially identified “kinds of supports” (strict inclusion semantic relationship, X is a kind of Y) and “parts of the support system” (spatial semantic relationship, X is a part of Y). These domains included similar subcategories: orientation, beginning teacher meetings, PLC, content-focused district seminars, mentors, induction coach, induction coordinator, colleagues for “kinds of supports”; and orientation, beginning teacher meetings, colleagues, mentor, induction coach, induction coordinator, colleagues, and administrators for “parts of the support system.” I collapsed these domains into “kinds of supports,” then features of the various support providers became new domains—for example, characteristics of mentor/mentee meetings. See Appendix K for examples of my taxonomic analysis.

To determine the patterned nature of emerging themes and to compare categories for instances of contrast within and across domains, I conducted componential analysis. In componential analysis, domains are examined for dimensions of contrast. For example, I found that the nature of the questions asked during induction activities differed from participant to participant, ranging from procedural to instructional in focus. Additional, componential analysis showed that the topics covered during induction activities were not those topics that the beginning teachers took up or asked about. Therefore, this final stage of analysis enabled me to develop a sense of what was important to the various participants—beginning secondary science teachers and school and/or district personnel—of the induction activities. See Appendix L for examples of my componential analysis.

Memoing was also used with the intent of tying “together different pieces of data into recognizable clusters to show that those data are instances of a general concept” (Miles & Huberman, 1994, p. 72). Additionally, I did not use line-by-line analysis for all of my data analysis. For example, I used memos to characterize the organization of beginning teacher and PLC meetings and the beginning secondary science teachers’ overall participation during these meetings.

Analysis of Identities-in-Practice

To analyze participants’ identities-in-practice, I initially coded data using Wenger’s (1998) modes of belonging as originally proposed; however, engagement, imagination, and alignment did not fit the stories my participants told. Since they had to hit the ground running at the start of the school year as fully functioning members of their communities of practice, their modes of belonging and trajectories of participation within their communities of practice proved insufficient for analyzing participants’ identities-in-practice. Once I recognized that mapping Wenger’s modes of belonging onto my participants’ stories and experiences was not the best fit, I started looking at normative identities within the context of their induction supports and classroom science teaching (Carlone, Haun-Frank, & Webb, 2011; Cobb, Gresalfi, & Hodge, 2009). In their study of normative identities in mathematics classrooms, Cobb et al. (2009) defined normative identity as comprising

> both the general the specifically mathematical obligations that delineate the role of an effective student in a particular classroom. A student would have to identify with these obligations in order to develop an affiliation with classroom mathematical activity and thus with the role of an effective doer of mathematics as they are constituted in the classroom. Normative identity is a collective or communal notion rather than an individualistic notion. (pp. 43–44)

By considering the promoted ways of being a beginning science teacher within the context of various induction supports, normative identity allowed me to examine the structures that enabled and constrained the beginning secondary science teachers' participation, identities, and thus learning. Normative identity enabled me to ask: What does it mean to be a "good" beginning science teacher in this community? That is, what were the afforded identities-in-practice of participants' induction experiences and supports? To more fully develop an understanding of participants' identities-in-practice, I not only considered the afforded identities-in-practice, but the identities-in-practice enacted by participants during their induction supports as well as the meanings they made of their various supports.

Within-Case Analysis

Due to the large amount of data I collected, within-case analysis was key to the data analysis process (Eisenhardt, 2002). Within-case analysis "[involved] detailed case study write-ups" for each teacher's induction experiences, meaning making, and identities-in-practice (Eisenhardt, 2002, p. 17). Though these case study write-ups were mainly descriptive, they "help[ed] [me] cope early in the analysis process with the often enormous volume of data" (Eisenhardt, 2002, p. 17) by becoming "intimately familiar with each case as a stand-alone entity" (Eisenhardt, 2002, p. 18). For each beginning secondary science teacher, within-case analysis resulted in an in-depth description of the meanings they made of their induction experiences, the identities-in-practice they enacted d participating in their induction activities and during classroom teaching, and the identity affordances of the induction supports in which they engaged.

Cross-Case Analysis

Along with completing four within-case analyses, I used cross-case analysis to search for patterns among the beginning secondary science teachers' induction experiences. This is important "to deepen understanding and explanation" (Miles & Huberman, 1994). To do this, I applied dimensions from my domain, taxonomic, and componential analyses to "look for within-group similarities coupled with intergroup differences" (Eisenhardt, 2002, p. 18). With regard to meaning making and identities-in-practice among the beginning secondary science teachers and identity affordances of the induction supports, I conducted my cross-case analysis by searching for patterns of meaning making and identities-in-practice among the individual secondary science teachers. I summarize my data sources and data analysis strategies for each research question in Table 8.

Researcher's Role and Perspective

Having previously worked as a high school science teacher, I believed that my induction support was left wanting. I felt prepared for my first year of teaching by my teacher education program and student teaching; however, once there I felt little support.

Feeling little to no support from the district or school, I more than likely would not have remained in the classroom had it not been for the support of my colleagues—those in my department, but new and experienced teachers in other departments as well—or experiences with my students. Informal happenings in my day-to-day teaching did more to shape my perceptions of teaching in general and science teaching specifically than did orientation, beginning teacher meetings, or my mentor. Also, during the four years that I taught, I saw numerous science teachers come and go, science teachers who more than likely would have been successful in the classroom if they had more support.

Table 8. Crosswalk for Study of Beginning Secondary Science Teacher Induction

	Data Sources								
	Interviews				Observations (with brief follow-up interviews)				
Research Questions	Before Start of Year	1st	2nd	3rd	Induction Activities	Mentor/ Mentee	Curriculum Planning	Teaching	Data Analysis
1. How do beginning secondary science teachers experience induction?	X	X	X	X	X	X	X		Contact summary sheet; domain analysis; taxonomic analysis; componential analysis; memos
1.a. What meanings do beginning secondary science teachers make of their induction experiences	X	X	X	X	X	X	X		Contact summary sheet; domain analysis; taxonomic analysis; componential analysis; memos

Table 8 (cont.)

	Data Sources								
	Interviews				**Observations (with brief follow-up interviews)**				
Research Questions	**Before Start of Year**	**1st**	**2nd**	**3rd**	**Induction Activities**	**Mentor/ Mentee**	**Curriculum Planning**	**Teaching**	**Data Analysis**
1.b. What meanings of "science teacher" are implied by their induction experiences? In other words, what are the identity affordances of their induction experiences and supports?		X	X	X	X	X	X		Contact summary sheet; domain analysis; taxonomic analysis; componential analysis; memos
1.c. What identities-in-practice do beginning science teachers enact during their induction experiences?	X	X	X	X	X	X	X		Contact summary sheet; domain analysis; taxonomic analysis; memos
2. What identities-in-practice do beginning secondary science teachers enact during their classroom science teaching?								X	Contact summary sheet; domain analysis; taxonomic analysis; memos

I believed that support for beginning teachers should come from the district, school, and department. Beginning teachers should be provided with a general overview to the district's and school's policies; however, induction support should also be content-focused. Based on my background—both as a former high school teacher and someone who has worked with pre-service secondary science teachers for the past three years—I believed induction support should also focus on content and instruction. Also, support should be developmental. For beginning secondary science teachers, then, induction support should be science-focused and developmental, focusing on issues of science teaching specifically while addressing typical concerns that arise for beginning teachers.

As the university's Noyce project coordinator at the time of this study, I provided support to beginning secondary science teachers. As previously described, I aimed to respond to the instructional and emotional need of the program's teachers. Though we did meet face-to-face on a monthly basis—as did the beginning teachers at the Noyce teachers' schools—I maintained communication with the Noyce teachers through email, telephone, and in person as well as through monthly newsletters and our cohort website. The Noyce teachers themselves also provided support for one another. By responding to the individual and collective needs of the Noyce teachers, I aimed to provide both science-focused and developmental support. In addition to supporting the Noyce teachers already in the classroom, my other primary job responsibilities were to recruit our next cohorts of Noyce interns and scholars. These Noyce scholars would represent the university's next group of Noyce teachers.

Inevitably, I brought these perspectives and assumptions to my data collection and analysis. Below, I discuss the ways in which I addressed this and other validity threats.

Validity

According to Joseph Maxwell (2002) there are five broad categories for understanding validity in qualitative research: descriptive validity, interpretive validity, theoretical validity, generalizability, and evaluative validity. Descriptive validity encompasses the factual accuracy of the researcher's account. Interpretive validity is concerned with "what these [those referred to in the factual account] objects, events, and behaviors *mean* to the people engaged in and with them" (italics in original, Maxwell, 2002, p. 48). In discussing matters of interpretive validity, Sharan Merriam (2002) asserts, "in qualitative research, the understanding of reality is really the researcher's interpretation of participants' interpretations or understandings of the phenomenon of interest" (p. 25). Given this, it was necessary to ensure as much as possible that research findings—"the researcher's interpretation of participants' interpretations or understandings" (Merriam, 2002, p. 25)—were as true to and consistent with participants' realities as could be. To establish descriptive and interpretive validity, I used member-checks throughout the study to ensure that my interpretations of the data were true to the participants' experiences. Additionally, I used multiple data collection methods and multiple sources of data, as well as rich descriptions, to establish descriptive and interpretive validity. Triangulating data sources allowed me to "build a coherent justification for themes" (Creswell, 2003). Potential threats to descriptive and interpretive validity included researcher bias and reactivity (Maxwell, 2005). To protect against my personal perspectives and assumptions clouding my interpretation of the data, I used member-checks. Also, with all interviews, there is the potential for reactivity, for me, as the interviewer, to influence the participant's responses. To minimize this threat, I avoided asking leading questions and used member-check to ensure that my descriptions and interpretations based on interview data were accurate for the participants.

Theoretical validity, according to Maxwell (2002), "refers to an account's validity as a *theory* of some phenomenon. Any theory has two components: the concepts or categories that the theory employs, and the relationships that are thought to exist among these concepts" (italics in original, Maxwell, 2002, p. 51). Since "the issue is the legitimacy of the application of a given concept or theory to established facts" (Maxwell, 2002, p. 52), I used peer reviews to "assess whether the findings are plausible based on the data" (Merriam, 2002, p. 26).

Maxwell attests that "generalizability refers to the extent to which one can extend the account of a particular situation or population to other persons, times, or settings than those directly studied" (2002, p. 52). In qualitative research, there are two aspects of generalizability: internal generalizability and external generalizability. Internal generalizability refers to "generalizing within the community, group, or institution studied to persons, events, and settings that were not directly observed or interviewed," whereas external generalizability refers to "generalizing to other communities, groups, or institutions" (Maxwell, 2002, p. 53). Defined these ways, internal generalizability is more important in qualitative research than external generalizability that is valued in quantitative research. To establish internal generalizability, I used purposive sampling strategies and discussed my data collection and analysis methods as transparently as possible. Additionally, I provided rich, thick descriptions so that "readers will be able to determine how closely their situations match, and thus whether findings can be transferred" (Merriam, 2002, p. 29).

Maxwell's (2002) final category of validity, evaluative validity, "involves the application of an evaluative framework to the objects of study" (p. 55). In this study, which was descriptive and interpretive in nature, I made no claims about evaluative validity.

The notions of validity discussed above (Maxwell, 2002; Merriam, 2002) differ from the conceptions of validity in quantitative research. In quantitative research, there are typically three forms of validity: content validity that is concerned with how well the questions represent all possibilities of available questions; criterion-referenced validity that is concerned with how well the scores on an instrument relate to an outcome and predict future outcomes; and construct validity that is concerned with what the scores on an instrument signify (Creswell, 2005). Unlike the categories of validity in qualitative research discussed above, these forms of validity focus on generalizability and statistical representation.

Ethics

I remained cognizant of my ethical commitments to the participants that their shared comments were confidential. Aliases, therefore, were assigned to participants during data analysis and continued to be used when reporting the findings. Furthermore, the purpose of the study was made transparent to participants at the onset.

Since I studied beginning teachers, I was also aware of the impact of my presence (reactivity, Maxwell, 2005). With the participants having to deal with and balance the myriad pressures and demands of being a beginning teacher, I needed to ensure that my presence would not cause them undue stress. In aiming to accomplish this, I limited the beginning teachers' investment to four formal interviews. The additional data collection (during induction activities, mentor/mentee meetings, and curriculum planning/PLC meetings) occurred during times and events to which beginning teachers were already committed due to the nature of their job. Based on my prior experience with ethnographic research in the classroom, I recognized, however, that my presence, at times, may have served as a support for the beginning secondary science teachers in this study. This possibility was reflected in my start codes for data analysis.

Summary of Chapter III

In this chapter, I described the qualitative research design of this study. I conducted this study using an interpretive lens, and aimed to describe the induction experiences, meaning making, and identities-in-practice of four beginning secondary science teachers.

CHAPTER IV

FINDINGS

For each case (beginning secondary science teacher) in this study, I gathered data through initial and follow-up interviews with the beginning secondary science teachers; interviews with school and district personnel who planned and conducted their induction activities; observations of their participation in induction activities, professional learning communities, and mentor/mentee meetings; and observations of their classroom science teaching. See Figure 1 for a summary of the induction supports in which Sophia, Ingrid, Jessica, and Whitney participated; these supports were previously described in Chapter III.

Below, I list the primary research questions and sub-questions that guided this study:

Primary Research Question #1:

How do beginning secondary science teachers experience induction?

Sub-questions:

a. What meanings do beginning secondary science teachers make of their induction experiences?
b. What meanings of “science teacher” are implied by their induction experiences? In other words, what are the identity affordances of their induction experiences and supports?

c. What identities-in-practice do beginning secondary science teachers enact during their induction experiences?

Primary Research Question #2:

What identities-in-practice do beginning secondary science teachers enact during their classroom science teaching?

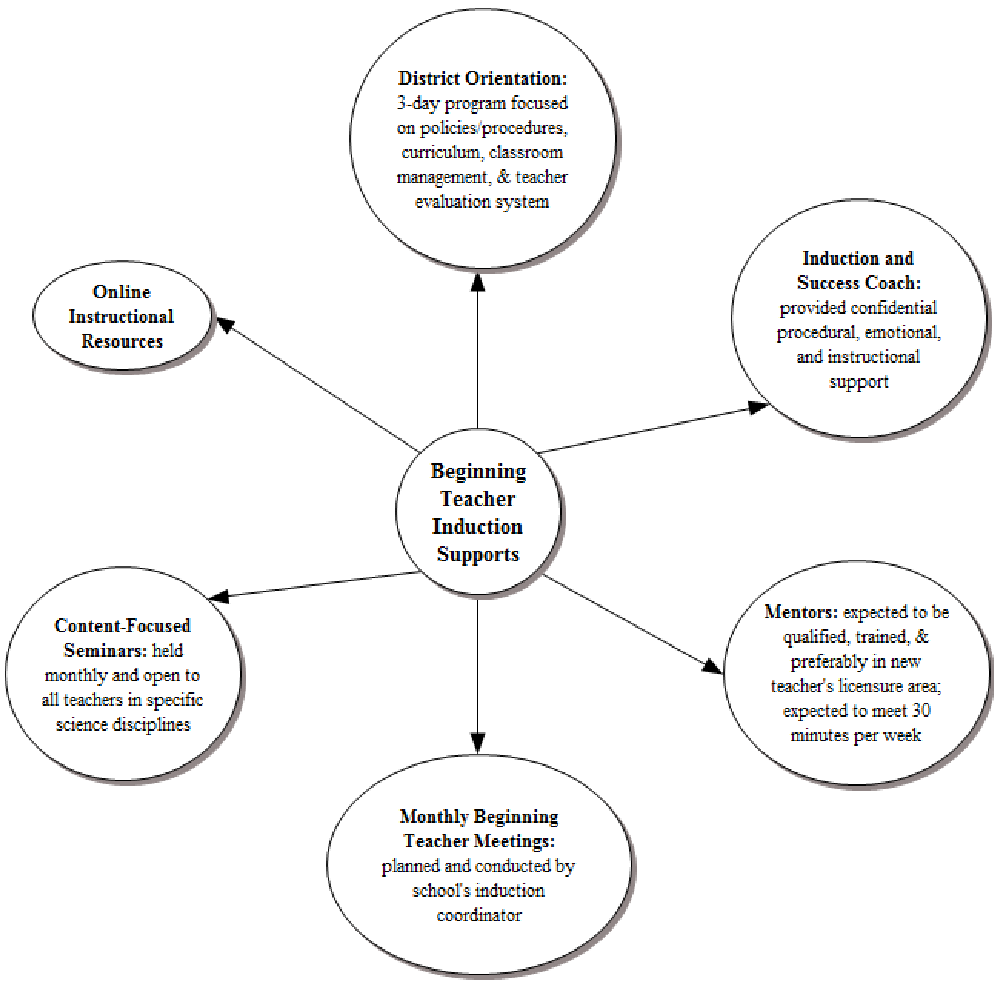

Figure 1. Concept Map of Components of Beginning Teacher Support within the School District

The findings I present here tell the stories of how the beginning secondary science teachers experienced induction—the supports available to them, the identity affordances of the supports, the meanings they made of their supports, and the identities-in-practice they enacted during their induction experiences and classroom science teaching. Though these beginning secondary science teachers taught in the same school district, they each experienced their induction differently in their school-based contexts; therefore, I present each beginning secondary science teacher individually. I develop an overall portrait of them as beginning secondary science teachers and discuss the identity affordances of their induction experiences. I also explore the meanings they made of their induction supports and experiences and the identities-in-practice they enacted during their induction experiences and during their classroom science teaching. I conclude with a cross-case analysis of how the four beginning secondary science teachers experienced their induction

Sophia

Portrait of Sophia

Sophia graduated from a traditional undergraduate teacher preparation program at a four-year public university (student population 28,916[3]) in the southeastern United States licensed to teach high school science. Though she had "always loved science" and was inclined to teaching as well, she "didn't see it [teaching] as a career plan for a long time" (initial interview, 9/28/2010). Around the time she decided to pursue science

[3] To protect the identity of my participants, the student population numbers reported here are from the Carnegie Foundation (http://classifications.carnegiefoundation.org/) instead of each participant's university.

teaching, she was running out of classes to take for her biology major. Instead of graduating early, she decided “let’s add an education program. It’s five more classes and that’s about how many more I need before I graduate” (initial interview, 9/28/2010). After teaching classes at her church to younger children and working with mostly adults as a CPR instructor, Sophia decided “maybe I could do high school, maybe they’re not too old for me” (initial interview, 9/28/2010).

In working with high school students, Sophia recognized the amazing potential she had as a mentor to her students:

> [B]ecause they’re older it puts me in a position where I’m basically standing in the doorway . . . Where they are in high school and like wherever they’re going . . . But I also have to catch them up with everything their other teachers didn’t do, so I can kind of save them in that kind of way and then I can also be kind of this source of information for what they should do afterwards too. (initial interview, 9/28/2010)

In fact, when she talked about her vision for science teaching, her relationships with students were central. She aspired

> to be an educator that can inspire a student to love my subject, but more than that to inspire them to be a better person and to be back on track with getting all that they can out of their education overall, through all subjects. (initial interview, 9/28/2010)

Though she had not yet determined how to accomplish it, she recognized that her

> ultimate vision would be being the teacher that all the kids trust and have a personal relationship with in that—going back to the mentor thing—that I can inspire them to love science but also get them to be the best person that they can be overall, in all subjects. (initial interview, 9/28/2010)

During her first year of teaching, Sophia taught honors and standard earth/environmental science. At the end of her first year, she reflected fondly on her experiences as a new teacher, remarking that her first year was less stressful and easier than her student teaching (final interview, 5/31/2011). She attributed this to the support she received: "I think that I had a lot more support here than I had during student teaching. So, just in people to share ideas with and people to, you know, people to divide up work with" (final interview, 5/31/2011). As Sophia reflected on her first year of teaching, her vision of building and maintaining positive relationships with students remained evident. She explained how this vision was met with both success and challenges throughout the school year:

> I'm gonna say [my] biggest success and half of, half of challenge . . . is just relationships with students . . . I've been able to have a relatively strong relationship with students and I think that I've been able to make good connections with them . . . At the same time I think that kind of ties into . . . [my] biggest challenge, umm. Part of that has tied into going back to classroom management . . . because of some of the ease of relationships that I've had or made or whatever, it's not as easy to do classroom management stuff too. So, I need to find a balance between the two I suppose. (final interview, 5/31/2011)

While Sophia maintained that she learned the most about the importance of effective classroom management during her first year of teaching, she was most looking forward to improving on the teaching foundation she had laid for herself during the first year. Though she acknowledged that her lessons were "not effective without . . . classroom management and [students'] attention," she looked forward to "improving on the things that I currently have established . . . being able to build on what I learned and getting better. Feeling like I'm doing the job that I, that I need to be" (final interview, 5/31/2011).

At the conclusion of her first year as a high school science teacher, Sophia planned to return to her school again the following year. She anticipated teaching biology in addition to earth/environmental science.

Sophia's Induction Experiences (Research Question 1)

Sophia, Ingrid, Jessica, and Whitney taught high school science in the same school district; therefore, they received similar state and district supports as first-year teachers. Given this, I described the state's beginning teacher support policies as well as the ways in which the school district enacted these policies previously in Chapter III. I reference these descriptions in discussions of all four beginning secondary science teachers' induction experiences.

Toward the beginning of the school year, Sophia expected to gain moral support and encouragement from her various induction supports. She anticipated "support that says 'it's okay that you're struggling and this is what you can do'" (initial interview, 9/28/2010). As she explained,

> I want my induction process to kind of reinforce that, be like we know that you're struggling . . . but it's okay because this vision that you have [for science teaching] still exists and you can still accomplish this and this is how you can get to your vision. (initial interview, 9/28/2010)

District orientation, and induction and success coaches. Sophia attended all three district orientation days prior to the start of the school year. Though she felt that some of the orientation's content was a review of her teacher preparation program, Sophia appreciated meeting other beginning teachers from across the district. As she explained,

> meeting the other beginning science teachers during [orientation] was helpful in a couple ways . . . getting to know more people in the county, so that when you go to things like [district content meetings] or the county-wide training that you know more people and you have someone to say, you know, how's it going, what are you doing that's working, that kind of thing. (follow-up interview, 10/5/2010)

As described in Chapter III, not only did Sophia meet other new teachers from across the district during orientation, but she met her induction and success coach as well. As Sophia's induction and success coach explained, she supported 26 new teachers (interview, 9/30/2010), with the district's other induction and success coaches working with similar numbers of beginning teachers. Sophia's induction and success coach described the myriad ways she supported Sophia and the other beginning teachers with whom she worked:

> I tried the first time that I saw them to go during a planning time when they were not in class . . . just to be able to say, how's it going; is there anything you need . . . do you have any issues; umm, answer, you know, any questions, you know, one-on-one that might have come up . . . [M]y next visits I would go during a class and, you know, do an observation. (interview, 9/30/2010)

She provided individualized support to the beginning teachers and responded to their emotional and instructional needs. Sophia's induction and success coach discussed helping beginning teachers with organization, grading, and making bulletin boards as well as with the emotional support they needed in feeling, as a new teacher who took work home on the weekends, isolated from their non-teacher friends. She met with her assigned beginning teachers on a regular basis and accommodated their needs if/when they requested an impromptu meeting (interview, 9/30/2010).

Sophia's induction and success coach did not report on Sophia's teaching performance to anyone at her school. In fact, as the Director of Induction and Professional Development emphasized, the relationship between beginning teachers and their induction and success coaches was confidential (interview, 10/21/2010). Sometimes this meant that while beginning teachers may have had strong school-based supports, they sometimes preferred seeking support from and talking with their induction and success coaches (interview with Sophia's induction and success coach, 9/30/2010).

Despite these intentions, Sophia found her induction and success coach to be among her least beneficial supports. Sophia's induction and success coach's primary responsibility was to support Sophia and other beginning teachers in whatever ways they needed (interview with Sophia's induction and success coach, 9/30/2010). However, despite this aim and regardless of periodic observations and meetings, Sophia found her induction and success coach to be more of a cheerleader than an instructional support (final interview, 5/31/2011):

> I feel like because she's so removed from the situation, you know, she comes around once every two weeks or so, she has helpful information while she's here, but because she's so removed from the situation, it's a little bit harder for her to give me speci-, you know, individualized support because I have to kind of explain what it is that is happening before she can give me suggestions (follow-up interview, 10/5/2010).

In her final interview, Sophia continued to explain the support she received from her induction and success coach, and the ways in which that support was problematic due to its removed, decontextualized nature: “She was a nice person to talk to and did provide some moral support, but…I think that because of how infrequently I saw her, she didn’t really know what was going on with the school or with the students…” (final interview, 5/31/2011).

Summary/interpretation of Sophia’s district-level induction supports. Sophia’s district-level induction supports afforded science teacher identities-in-practice centered on knowing and following policies and procedures. This was the primary focus of district orientation, and Sophia’s induction and success coach reinforced many procedures discussed in orientation. Though one of three days of orientation was focused on curriculum and lesson planning, the primary emphasis and promoted science teacher identities-in-practice during this time was focused on following the pacing guide and accessing the district’s online instructional resources. Within the context of her district-level supports, Sophia took up identities-in-practice of secondary science teacher as policy and procedure follower. As seen with the identities-in-practice Sophia enacted during other induction supports, Sophia looked for something valuable with each support she was provided, determined to gain something, anything in accord with the purpose of the support.

With a primary focus on district procedures and policies, Sophia interpreted the district induction as a repeat of her teacher preparation. She did, however, appreciate meeting other new teachers from across the district as well as her induction and success coach, all of whom served as emotional support during Sophia’s first year of teaching.

Though Sophia appreciated the intentions behind her district supports, overall she found them lacking in connection and relevance to daily classroom instruction. Since her induction and success coach visited about twice a month, she was not familiar with the contexts of Sophia's school or classroom, making her advice more of a pep talk than a conversation that had potential to greatly impact Sophia's science instruction. As the school year progressed, her induction and success coach fell into the role of emotional cheerleader instead of instructional supporter.

School-based supports. As described in Chapter III, the beginning secondary science teachers received school-based induction supports in the form of mentors, monthly beginning teacher meetings, and their induction coordinators. Below, I discuss the school-based supports Sophia received.

Mentors. Sophia met with her mentor each week[4], and generally went to her mentor/mentee meetings with questions in hand. Additionally, if she needed her mentor between meetings, she did not hesitate to contact her. She was pleased with the consistent and supportive interactions with her mentor saying,

> my mentor . . . is awesome . . . [W]e do our weekly meeting, umm, and I know that my, that isn't the case for all the new teachers so the fact that my particular mentor is awesome and she basically said that hey, we need to have these weekly meetings. They need to be 30 minutes long, when, let's schedule them, and so we actually schedule . . . So, my mentor has been really supportive. (follow-up interview, 10/5/2010)

[4] Though Sophia reported meeting with her mentor each week, she only submitted one audio-recorded mentor/mentee meeting.

During our initial interview, Sophia described her mentor as “a very cheery, happy person typically and she, she’s really awesome” (initial interview, 9/28/2010). Not only did Sophia’s mentor help her to navigate her new school context, but she also provided

> positive support recognizing where, especially since she’s teaching, recognizing where the challenges are going to be, recognizing that I don’t know what an academic referral is and that I need to know what that is. And then also, she also shares lesson plans when I’m like, I don’t know what to do and I have to do something by tomorrow. She’s like, well actually this is what I did (initial interview, 9/28/2010)

In addition to being “awesome” and very supportive, Sophia also felt that her mentor frequently went above and beyond to help her, once during lunch “going online, finding something, printing out copies, and bringing it to me at the beginning of class” so that she could have a different lesson for her standard earth/environmental science class than the one she taught her honors students earlier in the day (follow-up interview, 10/5/2010).

When she met with her mentor, Sophia received instructional support, as well as advice on interacting with her colleagues and navigating the politics and bureaucracy of the school. She felt that her mentor/mentee meetings were her most helpful support, and appreciated the time and space to ask “new teacher question[s] . . . I write down questions during the week and talk about them there” (follow-up interview, 10/5/2010).

In the example below, Sophia came to her mentor/mentee meeting with questions about a student’s 504 plan. Additionally, she talked with her mentor about classroom management and instructional ideas.

> *Sophia*: OK, so the only thing that I have, which I don't even know that you will necessarily be able to answer because it really affects my kids and not general. And of course I don't have the students that I need. I have the students that I don't need. Umm, what kind of modifica-, what is the difference between a 504 plan and an IEP?
>
> *Mentor*: Umm, that's a tough-y. A 504 is exactly an IEP, but it accommodates for other health issues. It can be diabetes, where they have food in your class. They can leave to go to the restroom, get water when they need to. Umm.
>
> *Sophia*: Would it be for ADD, or?
>
> *Mentor*: It can be. It's usually considered, umm, ADHD. Sometimes they'll do a 504 for those. So, it's a different legal binding document, umm, so. It's mainly
>
> *Sophia*: Technically major life activities such that activities are majorly limited by the impairment. Learning.
>
> *Mentor*: Yeah. It's usually when they don't have a discrepancy between. It's like a . . . They don't have necessarily a learning disability… But, they have issues that may affect their learning . . . It's to accommodate things like that or extended time. Separate setting. Those kinds of things, but it's not necessarily . . . due to a learning disability or resulting in a learning disability. (mentor/mentee meeting #1, 4/2011)

Sophia asked her mentor about 504 plans because of an issue that arose in her class: She knew a student had a 504 plan, but had not received notice of his accommodations. After turning in a late assignment, the student disputed his penalized grade, citing his 504 accommodations. Not knowing who in the school to ask for the student's 504 plan, Sophia sought the advice of her mentor, who actually made the contact for her.

> *Sophia*: I mean, it would be helpful if I had his 504 plan in the first place. Who do I talk to?
>
> *Mentor*: Mrs. X.
>
> *Sophia*: Mrs. X. OK.

> *Mentor*: Yep. I can send that email because she's kind of cranky . . . What's this kid's name? (mentor/mentee meeting #1, 4/2011)

Sophia's mentor typed an email on Sophia's behalf to the school's 504 coordinator (mentor/mentee meeting #1, 4/2011).

At a different point during the mentor/mentee meeting, Sophia asked for her mentor's input regarding a recurring classroom management issue—students repeatedly threw objects across the classroom.

> *Sophia*: Kids have already been suspended [for throwing things across the classroom]. I've said 100 million times that you're not allowed to throw things in class. And he was like, but you didn't give me a warning. And I was like, you, you should know that you're not allowed to throw . . .
>
> *Mentor*: Are these lab supplies or just general coloring?
>
> *Sophia*: Pencils, crayons. That kind of thing.
>
> *Mentor:* Yeah, I did a lab today with beans and my first statement was if I see a bean fly, it's on. I didn't actually say that, but I told them that I would remove them from the lab setting and they would take a zero for the lab because I'm not gonna play bean games. Umm. So, just if you're gonna have those things out, tell them at the beginning just a reminder. Do not throw these things . . . Just to put it fresh in their brain again so they don't do something stupid and go, oh yeah I forgot. (mentor/mentee meeting #1, 4/2011)

During Sophia's mentor/mentee meetings, she and her mentor positioned one another and themselves more as colleagues and less as an experienced teacher-novice teacher dichotomy. In fact, Sophia's mentor frequently talked about the issues she faced in her biology teaching as well. These shared experiences and feelings centered on classroom management and instruction.

> *Sophia*: I absolutely don’t want to give them worksheets for the sake of worksheets because I don’t want to be like some people. But . . . Umm, I’ve been, for my standard kids I’ve been giving, you know, after we go over, after I teach about it, I say and now you’re gonna do this worksheet.
>
> *Mentor*: To reinforce.
>
> *Sophia*: [Y]ou know the ones that the textbook already has made. And, umm, I think, ‘cause they need, especially those standard kids. They need to practice.
>
> *Mentor*: They need to be in a book and work on their literacy.
>
> *Sophia*: And, and they need to, you know, they need to have a chance to manipulate the information and
>
> *Mentor*: Uh-hum. I totally agree with that for my standard bio class.
>
> *Sophia*: Anyway they can. So, I teach it first, but then give them a worksheet and . . . I think that it’s been working. Or it seems that they’re getting a little bit better.
>
> *Mentor*: That’s exactly how I taught marine and environmental . . . (mentor/mentee meeting #1, 4/2011)

While Sophia talked about her difficulties gauging whether her students actually understood the information she taught them, her mentor talked about how this is difficult in standard-level courses because students typically copied from one another’s worksheets.

> *Mentor*: Standards a lot of time end up copying each other on worksheets. That’s a problem I’m facing with my standard class.
>
> *Sophia*: Yeah, it’s a problem that I’m facing and it’s, I. I’m debating whether or not I should just, you know, the next time if I see you copying I am taking it away from you and ripping it in half and giving you a zero. Like, don’t copy each other. It does not help you. You do not learn if you copy what they do
>
> *Mentor*: And if they’re working collaboratively and discussing it . . . I have no problem with that. (mentor/mentee meeting #1, 4/2011)

This exchange about experiences and ideas was more conversational in tone as compared to Ingrid's mentor/mentee meetings that centered on transmission of information. According to Sophia, this back and forth about classroom management and instruction was a hallmark of her interactions and meetings with her mentor.

Summary/interpretation of Sophia's mentor support. During the initial, follow-up, and final interviews, Sophia consistently named her mentor as her greatest support. Rather than positioning one another to fit within the expert-novice hierarchy, Sophia and her mentor interacted as colleagues, engaging in give-and-take dialogue to discuss issues and solutions related to their instruction. While I observed this collegial dialogue during the one audio recorded mentor/mentee meeting I had for Sophia, this was not the image of mentor support Sophia portrayed in our interviews. Rather, as Sophia emphasized in our final interview, "there just really wasn't a question she couldn't answer or if she couldn't answer it then she figured it out" (final interview, 5/31/2011), conveying a transmission-focused conception of mentor support. Sophia had questions and her mentor had answers; Sophia needed information and her mentor had the information she needed. Looking across data, Sophia's mentor/mentee meetings afforded identities-in-practice focused on collegiality and positioned her as a budding professional. In practice, Sophia took up identities-in-practice that underscored her position as a novice seeking information from her more experienced mentor.

During their mentor/mentee meetings, Sophia was comfortable asking questions and discussing issues as she worked to improve her classroom management and instruction. As Sophia continually iterated during our interviews, her mentor had the greatest impact on her instructional growth and development during her first year of teaching. That Sophia found this one-on-one mentoring so supportive and valuable should be no surprise; induction literature focused on the supports beginning teachers find helpful noted that mentoring provides the support they seek (Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009).

Beginning teacher meetings. In addition to her mentor, Sophia also received school-based support in the forms of monthly beginning teacher meetings and her school's induction coordinator. At Sophia's school, the induction coordinator worked very closely with an assistant principal and another experienced teacher to support the new teachers at the school. Sophia described the beginning teacher meetings and the developmental progression of topics discussed at the meetings over the course of the school year:

> We had meetings every Friday morning . . . and discussed a whole bunch of different topics. At the very very beginning of the year it was more procedural, like . . . [W]ho is the school secretary? Who is the school treasurer? What do you do if you need to you know, get paper or whatever kind of some of that stuff? . . . Then as the year progressed, it became more ummm each session would have a different topic. So, activating prior knowledge or differentiating instruction or umm or techniques to improve literacy. (final interview, 5/31/2011)

During a beginning teacher meeting that I observed, Sophia and the school's other beginning teachers presented strategies for activating students' prior knowledge to the rest of the group. During a previous beginning teacher meeting, the beginning teachers worked in pairs to prepare posters describing their assigned activating strategy, how to use it, and how students benefit from the strategy. For the meeting I observed, beginning teachers presented their posters. Sophia and her partner presented on concept maps; they made a “concept map about concept maps.” After the presentations, beginning teachers were asked to share what they felt they needed on an exit slip (observation, 3/18/2011). Overall, Sophia felt the beginning teacher meeting was helpful and discussed strategies she would use in her classroom:

> I thought it was helpful to see some of the different, umm, ways of organizing information, and the kind of the different strategies they were showing. I think some of them I can definitely use. I think that it would have been helpful . . . [to do] a quick summary, ‘oh remember this person and this person presented this and these are the major points of it,’ because I wasn’t taking notes . . . And some of them I’d used before, I’d heard of them before, but some of them were new, so it was definitely something I can use. (interview, 3/21/2011)

Sophia also found it beneficial that the induction coordinator and assistant principal asked the beginning teachers what they felt they needed. Sophia responded that she would like more support and guidance in providing her students a nurturing classroom (interview, 3/21/2011).

Summary/interpretation of Sophia’s beginning teacher meetings. Unlike other beginning secondary science teachers in this study, Sophia attended weekly, rather than monthly, beginning teacher meetings. In accord with the teacher induction literature (Berliner, 2001; Hammerness et al., 2005), the focus topics of her beginning teacher meetings progressed developmentally, starting with a focus on policies and procedures and shifting to a focus on methods for effectively organizing and presenting content as the school year continued. See Figure 2 for the progression of topics discussed during Sophia’s beginning teacher meetings throughout the year. Additionally, Sophia’s experiences during her beginning teacher meetings aligned with Luft and Patterson's (2002) practices during the ASIST program: The topics should be adjusted and modified as needed based upon feedback and the needs of the beginning science teachers. This progression afforded beginning science teacher identities-in-practice as a developing professional whose needs were expected to change over time and with experience. Her beginning teacher meetings aligned with and provided support for these changing needs as Sophia developed as a teacher over the course of her first year of teaching. This context enabled Sophia to take up beginning science teacher identities-in-practice as someone whose needs during her first year of teaching could and would change. She also enacted beginning science teacher identities-in-practice focused on mining something useful from each support during her beginning teacher meetings. In this regard, Sophia found the meetings later in the school year especially impactful on her instruction, and enjoyed the opportunity to meet and talk with other beginning teachers throughout the school year. As the concerns of beginning teachers were expected to change over the course of the school year, so did the topics discussed during Sophia's weekly beginning teacher meetings (interview, 3/21/2011; final interview, 5/31/2011).

Figure 2. Topics Discussed During Sophia's Weekly Beginning Teacher Meetings

Additional induction supports. Aside from the district- and school-based supports previously discussed, Sophia discussed several other induction supports that extended those called for in the state's beginning teacher support policies. These included colleagues and her professional learning community, other beginning teachers, administration, district-wide content-focused seminars, the district's online instructional resource management system, and additional trainings she attended.

Colleagues and professional learning communities. At the start of the school year, Sophia recognized the vital importance of her colleagues. In fact, she frequently sought support from colleagues other than her mentor:

> [A] couple particular teachers, even though they're not my mentor I, especially during the first week, . . . I think I went to this one teacher every day because she . . . teaches two doors down from me . . . Every day, at the end of the day, I'd walk in and say, 'dumb new teacher question, dadada.' So, my particular staff that I work with has been really supportive too . . . I have a supportive, helpful staff to work with. (follow-up interview, 10/5/2010)

In addition to relying on the support of her nearby colleagues for "new teacher questions," Sophia also heavily relied on the support she gained from colleagues in her earth/environmental science professional learning community (PLC).

Weekly, Sophia attended two PLC meetings. The first, with the whole science department, was a time and space for the science department chair to share important announcements (final interview, 5/31/2011). After the announcements, the science teachers broke into smaller discipline-specific PLCs. At this time, Sophia met with the two other standard earth/environmental teachers and the other honors earth/environmental science teacher. These meetings had a planning function, as they discussed "the order in which we were gonna teach things" (final interview, 5/31/2011). They also decided on resources and instructional activities, sharing responsibility for developing activities, presentations, and tests: "Because we were all starting basically from square one, we could do a lot of, like, dividing up work and. Like, this is what we need to achieve. Let's divide it up so that we get there faster" (final interview, 5/31/2011). Since she and her earth/environmental science colleagues were relatively new at teaching the subject—no one had more than four years of experience teaching earth/environmental science—they appreciated and relied on this division of labor aspect of their PLC. As a beginning teacher, Sophia found this to be especially true: "[H]aving my PLC definitely decreased the amount of work that I had to do, umm, which was nice, especially as a first-year teacher" (final interview, 5/31/2011).

During a set of PLC meetings that I observed, the initial meeting with the whole science department was mainly informational[5]. Though the principal was present, the science department chair (and Sophia's mentor) led the meeting. She talked to the science teachers about the end of the 9-weeks, grades, and make-up work. They also talked about an upcoming professional development on literacy strategies. When she was finished, the principal talked more about the professional development and common assessments. Once the department meeting was over, Sophia moved next door for the earth/environmental science PLC meeting (observation, 3/23/2011).

Next, during the earth/environmental science PLC meeting, she and two other earth/environmental science teachers discussed the rest of their severe weather unit, the

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[5] The informational nature of this science PLC was typical of other science PLCs I observed (observation, 5/11/2011; observation, 5/18/2011).

upcoming units on oceans and astronomy, and the final exam. They scheduled how long the remaining units should last to allow time for exam review as well as made a schedule for what they would discuss and do during upcoming PLC meetings.

Throughout this earth/environmental science PLC, Sophia was an engaged and active participant. In fact, she was very vocal when the group was mapping out the length of time for their remaining units and the exam review. She also participated in conversations about the product that will conclude the climate and biomes unit, frequently providing input (contact summary of observation, 3/23/2011).

During another earth/environmental science PLC, Sophia and her earth/environmental science colleagues discussed completing the oceans and marine animals unit (for standard), and the oceans test and teaching astronomy (for honors). Sophia freely discussed with her colleagues that she regarded her honors earth/environmental science oceans test as poorly written. They offered to help her modify and improve it for standard earth/environmental (observation, 5/11/2011). During this meeting, Sophia was willing to share ideas, materials, and resources with her earth/environmental science colleagues. Likewise, they seemed interested in her ideas, materials, and resources, and willingly shared their own (contact summary of observation, 5/11/2011).

Familiar with professional learning communities from her teacher preparation program, Sophia was very excited that her school followed this model. However, she admitted that

> our particular environmental science PLC has been kind of struggling, floundering, mostly adjusting to the fact that we have a strange dynamic . . . Umm, but we are able to share, especially like the tests and quizzes and stuff that we do. We can share activities and share that kind of thing too. (follow-up interview, 10/5/2010)

Sophia explained this "strange dynamic" with so many personalities teaching—and trying to collaborate on teaching—earth/environmental science:

> [The other standard earth/environmental science teacher] and I are both kind of like, uh, we barely know what we're doing . . . [We] are like, just trying, you know, surviving. [The AP environmental science teacher] is kind of trying to come into this new role as coordinator, which she didn't necessarily ask for, but it's kind of been just her natural place in it, and then [the other honors earth/environmental science teacher who also teaches chemistry] doesn't care. She doesn't, doesn't want to be doing it. She will cooperate because she has to, but doesn't, if she had her own choice there would be no PLC-ing . . . (follow-up interview, 10/5/2010)

Though her professional learning community did not always function as Sophia had come to expect based on her experiences in her teacher preparation program, she did appreciate that "I didn't have to do stuff on my own" and that she was able to share and get ideas (final interview, 5/31/2011).

Outside of her science department, Sophia also drew support from other beginning teachers at her school. While her science colleagues and mentors provided her with emotional and instructional support, she turned to other beginning teachers for camaraderie and emotional support (follow-up interview, 10/5/2010). They talked about their experiences and confided in one another the struggles of being a first-year teacher: "[I] talked to other first year teachers about how some days I just wanted to cry" (final interview, 5/31/2011).

Summary/interpretation of Sophia's supports from her colleagues and PLCs. Sophia's earth/environmental science PLC afforded opportunities for her and other earth/environmental science teachers to take on instructional leadership-type identities-in-practice within the PLC. For example, each participant was able to contribute ideas and resources as the earth/environmental science teachers planned their instruction. Outside of planning, there were limited opportunities for instructional decision making based on common assessment data. While PLC afforded identities-in-practice focused on instructional planning and collaboration (when Sophia's honors earth/environmental science colleague did not contribute, she earned a bad reputation with the PLC), there was a limited focus on instructional improvement and growth. Within this context, Sophia took up the promoted instructional planning and collaborative identities-in-practice, sharing and gaining ideas during PLC and working with the other standard earth/environmental science teachers to divide the work (e.g., create notes, Power Points, review sheets, tests; develop activities) that needed to be done.

Though Sophia's science department PLC was procedural in nature—a time and space of the department chair to make general announcements—her earth/environmental science PLC was more instructionally focused. Though the focus was more instructional, discussions during Sophia's earth/environmental science PLC seldom pushed beyond planning. While Sophia's earth/environmental science PLC seemed collegial and productive, it did not follow the 'big ideas' of PLCs defined in the literature (DuFour, 2004), nor did it align with what Sophia was expecting of her PLC based on her teacher preparation experiences. Sophia acknowledged that the mentality behind PLCs was a central component of her licensure program; therefore, she supported PLCs more than other earth/environmental science teachers, specifically, and science teachers, generally (interview, 3/28/2011). Similarly, she noticed that the planning function her PLC served, while helpful, was not what a "true PLC should be doing" (interview, 3/28/2011). According to DuFour, "the professional learning community model flows from the assumption that the core mission of formal education is not simply to ensure that students are taught but to ensure that they learn" (2004, p. 8). To achieve this vision, DuFour identified three big ideas of PLCs: 1) "ensuring that students learn," 2) fostering "a culture of collaboration," and 3) maintaining "a focus on results" (2004, p. 8-10). In Sophia's opinion, these premises of PLCs were not met. She recognized that the whole school was in the process of developing how they would work as a PLC school (interview, 3/28/2011). As the school year progresses, Sophia acknowledged that it was very useful to plan with other earth/environmental science teachers, and that as a PLC they improved in using common assessment data (interview, 5/13/2011).

Outside of the science department, Sophia garnered support from the other new teachers at her school. The emotional support other new teachers provided supplemented that provided by Sophia's induction and success coach, yet was sensitive to the school's specific context.

Administration. At the start of the school year, Sophia anticipated needing administration support primarily to back her classroom management and disciplinary decisions (initial interview, 9/28/2010). In fact, she found herself calling on such administrative support to help her regain control of her class after trying a more hands-off approach to classroom management:

> Because I started off trying to do probably too much of my not-as-directed, hands-on, a little bit more free-thinking things, I kind of, like, pushed them out of the airplane and said, 'you'll be fine.' And when you push them out of the airplane in the first month of school, what I've learned is they just talk to each other . . . and they're just really disruptive. So, umm, I've had to do some reigning back in of my classes and so administration helped me with that. (initial interview, 9/28/2010)

After expressing her concerns to the administration, they decided to do walk-throughs of Sophia's disruptive classes. As she explained,

> they just stop by and just their presence kind of helps with that so when I, when I expressed my concern that my 4th period was unruly and out of control and I didn't know what to do, the principal was like, 'okay well I'll make more stops by your room in 4th period.' So, he has. (initial interview, 9/28/2010)

On a different occasion, Sophia approached the administration with concerns over her students' tardy arrivals from lunch to fourth period. Again, her administration was supportive: "They said, 'hum, let's see what we can do about that.' So, it's unusual that an administrator doesn't stop by room at the beginning of 4th period just to say, hey, you're late; why are you late" (follow-up interview, 10/5/2010). Sophia appreciated their support in backing her policies, recognizing that "you know, I was saying it [about not being tardy after lunch], but obviously it was not, it's a little bit scarier when one of the APs says it to them or the principal" (follow-up interview, 10/5/2010).

Though supportive of Sophia as she worked to regain control of her disruptive classes, the administration was unsupportive of parts of her classroom management plan.

She recognized that, for the most part, the administration supported her instructional and disciplinary decisions; however,

> There was one thing that I thought was a really good . . . disciplinary idea and they basically said, 'yeah no we're not going to back up on that.' So if they [the students] don't follow through with that, then oh well. We're not going to back you up. (initial interview, 9/28/2010)

Summary/interpretation of Sophia's administrative support. Beginning science teacher identities-in-practice afforded by Sophia's administrative support aimed at being able to ask for the support or reinforcement needed to teach effectively. She was afforded opportunities to ask for and get help with classroom management, but within limits (e.g., the administration did not support all of Sophia's behavior management ideas). Within this context, Sophia enacted beginning science teacher identities-in-practice as someone who asked for, and generally received, disciplinary support so she could teach in ways that aligned with her vision. Sophia's administration was mostly supportive of her instructional and classroom management decisions, positioning her as a beginning teacher capable of making her own instructional and classroom management decisions but who could come to the administration if needed. Therefore, she felt comfortable approaching them with issues that arose during the school year, asking their advice, and seeking their help as needed.

Content-focused seminars and online resources. The aspects of the earth/environmental science PLC that Sophia liked and appreciated—hearing and sharing ideas, and receiving help to develop teaching materials—were the same features of the district's monthly content-focused seminars and online instructional resources management system that appealed to her.

Content-focused seminars. Early in the second semester, I observed Sophia, Ingrid, and Whitney at a district content-focused earth/environmental science seminar. The seminar began with an activity focused on the world's oceans. The names of oceans were placed on tables around the host school's media center. Participating teachers were given facts and asked to place them with the appropriate ocean. At the conclusion of the activity, the district's science curriculum coordinator reviewed the correct answers with the participating teachers. Next, one of the host teachers shared a flow water regimes video that one of her math colleagues had developed as part of her 'engage' piece of a 5E learning cycle lesson. The host teacher drew connections between this math 'engage' piece and the earth/environmental science curriculum. The district's science curriculum coordinator distributed a NASA teaching module that accompanied the host teacher's presentation. Some of the materials in this packet were discussed. Then, a teacher from a different high school shared the 'Sum of the Parts' activity from Project WET (1995). All of the participating teachers engaged in this activity in which they 'developed' a plot of land along a river. Sophia drew a landfill on her plot of land (piece of paper). All of the finished plots of land were assembled to form the rivers, and the teachers talked about how this activity could be used to talk about point and nonpoint source water pollution with their students. Next, the participating teachers completed two ocean currents activities: The first involved drawing a fish's path from one point to another taking into account the direction of ocean currents; the second involved matching pictures of ocean currents with their descriptions. Most participating teachers did the first activity in less than five minutes; the second activity took considerably longer and involved a rather extensive knowledge of world geography. While several participating teachers, including Ingrid and Whitney, stopped working on the activity before mapping the ocean currents, Sophia's table appeared to complete the entire activity. To end the seminar, participating teachers filled out a 3-2-1 feedback slip: three concepts/ideas/hints they were attracted to as immediately useful, two reminders that would impact their work with students throughout the year, and one curriculum/instruction related question/concern they still needed to figure out.

Sophia attended this and other content-focused seminars hoping "to gain activities to engage my students" (interview, 3/11/2011). For the most part, she accomplished this at the February seminar described above. While not all of the presentations and activities were completely helpful to Sophia, some of "the activities were relatively engaging and could probably be incorporated into my lessons" (interview, 3/11/2011). When asked whether she gained what she hoped to from the seminar, Sophia commented that she did,

> for the most part. Some of the activities (the ocean current mapping activity, specifically) seemed a little labor-intensive for the students to complete, but some of the other quick activities (the introductory activity and the fish's path sheet) would be helpful to assess prior knowledge or emphasize the concepts. (interview, 3/11/2011)

As demonstrated in the vignette above describing Sophia's participation in one of the district's earth/environmental science focused seminars, Sophia approached these and other supports looking to gain ideas, resources, and activities that she could use in her own classroom. More so than other beginning secondary science teachers in this study, Sophia strived to gain something from each induction support and professional development she attended, even when her colleagues did not strive for the same.

Online instructional resources. Having the online instructional resources available to use and modify was important to Sophia. Just as dividing the tasks that needed to be completed for her earth/environmental science professional learning community helped her save time and energy, Sophia liked the online instructional resources because she could "modify things…instead of starting from scratch" (final interview, 5/31/2011). She acknowledged that the online resources "saved me some time because I could modify things and it also, umm, gave me instructional type things to use" (final interview, 5/31/2011).

In teaching a course that was new to her—Sophia was a biology major and student taught in biology classes—Sophia frequently accessed and used the district resources available online. In fact, she attributed her success during her first year of teaching in part to having ready access to quality instructional materials:

> Umm, it's not to say that it (her first year) wasn't challenging and that it wasn't hard and that there weren't times that I was, that I had a hard time, but it probably wasn't as hard as it could have been. Umm, especially considering like how easy it was for me to go online and find something . . . and modify it, and I, you know, didn't have to make stuff up. (final interview, 5/31/2011)

Sophia was glad to have access to the district's online instructional resources and found them very beneficial because it was a "very easy, you know, go-to thing if I need something . . . for the next day. Even if it's something that I need to modify, especially before the PLC was really in full swing, or, umm, as full swing as it is now" (final interview, 5/31/2011). In fact, during our final interview, Sophia explained that, along with her mentor, the district's online instructional resources were one of her greatest supports. As she discussed, "I use stuff [from the district's online instructional resources] a lot, I feel like that's probably a resource that helps support me, the fact that there was stuff there" and because "a lot of times I could modify stuff from [the district's online instructional resources] . . . instead of starting from scratch" (final interview, 5/31/2011). This was important to Sophia, because "it saved me some time because I could modify things and it also, umm, gave me instructional type things to use" (final interview, 5/31/2011).

Summary/interpretation of Sophia's supports from content-focused seminars and online resources. The district's content-focused seminars presented activities and ideas that were new to Sophia, and thus held the potential to support her instructional growth. While some of the activities were more easily incorporated into her instruction than others, Sophia tried several of the activities and strategies from the content-focused seminars. The district's content-focused seminars afforded dual perspectives of secondary science teacher identities-in-practice. On one hand, secondary science teachers needed to learn more about effective science teaching and good science activities. On the other hand, secondary science teachers who led the meetings were positioned as instructional leaders with important information to share with the district's other earth/environmental science teachers. Regardless of this duality (attendee as opposed to presenter), the district's content-focused seminars recognized the importance of content-focused instructional support (Ingersoll, 2006; Luft et al., 2003, 2007; Luft & Patterson, 2002; Patterson et al., 2003; Roehrig & Luft, 2006). During the content-focused seminars, Sophia took up identities-in-practice as a beginning earth/environmental science teacher who sought to gain an idea, activity, or resource from *every* support she attended. Coupled with the district's online instructional resources, Sophia saved time by modifying the activities and resources she was provided rather than developing new activities and resources on her own.

Sophia was also able to access quality instructional resources online, modifying them to suit her and her students' needs. This provided crucial instructional support for her as she taught a new preparation in a new content area, earth/environmental science; she was a biology major and student taught in biology. Sophia greatly valued the instructional support provided by the online collection of resource; thus having access to and using these resources contributed to Sophia's sense of success as a new teacher.

Additional "trainings." In addition to getting support from her colleagues and professional learning communities, administration, and the district's content-focused seminars and online instructional resources, Sophia also attended additional "trainings" sponsored by the school district. At the suggestion of her induction and success coach, Sophia attended a five-week workshop on proactive teaching strategies. She also attended school-wide training on literacy strategies.

As Sophia explained, the professional development recommended by her induction and success coach was

> proactive practices for today's classroom . . . So, I got, I, there's a lot of ideas that I liked from that class. I haven't really, I don't know that I've implemented that many of them yet, but I'm, one of my plans for the summer is to go over the notes that I took from that, or got from that class. And use them to kind of plan some stuff for next year, so. (final interview, 5/31/2011)

The professional development, which Sophia enjoyed and worked to incorporate into her classroom instruction, emphasized "giving directions and breaking directions down into one thing, and then the next, and then the next" (final interview, 5/31/2011).

Though not specifically for beginning teachers, the school-wide training on literacy strategies had an impact on Sophia and her teaching. As she explained,

> that was kind of somewhat eye opening just because, umm, either explicitly or not, . . . I feel that most education programs are like this, kind of de-emphasized the textbook . . . [W]hile it's true that people don't necessarily learn as well from a textbook and they learn better from hands-on, they need to be able to learn from a textbook . . . And that was kind of a distinction that makes complete sense, but I hadn't ever actually made . . . It's to teach them *how* to read the textbook so that . . . they're able to succeed in future. (final interview, 5/31/2011)

Though Sophia liked some of the presented literacy strategies better than others, she thought "the central idea behind it was probably the most important thing that I got from it" (final interview, 5/31/2011). In fact, she implemented some of these literacy strategies in her classroom science teaching. Two lessons I observed during which Sophia incorporated strategies from the literacy training are discussed below with Research Question 2.

Summary/interpretation of Sophia's additional "trainings." During her first year of teaching, Sophia attended additional trainings focused on classroom management and instruction. These trainings supplemented her other induction supports, namely her beginning teacher meetings, in their developmental nature. For example, in response to Sophia's early concerns with classroom management, her induction and success coach recommended that she attend a workshop on proactive classroom management strategies. Classroom management was discussed during district orientation and early beginning teacher meetings; the workshop on proactive classroom management strategies provided additional support as Sophia continued to develop her classroom management strategies and techniques. Similarly, toward the end of the school year as Sophia's focus and the focus of her beginning teacher meetings shifted to instruction, she participated in school-wide literacy training. Like aspects of what she learned during her beginning teacher meetings and other induction experiences, Sophia implemented, or planned next year to implement, key ideas from these trainings to better her classroom management and instruction. Sophia identified these experiences as supportive and valuable.

Summary/interpretation of Sophia's induction experiences. Of the various induction supports Sophia had access to as a beginning secondary science teacher, she most greatly valued the district's online instructional resources and her mentor: the online resources because she could turn there for instructional ideas and easily modify the materials and resources to fit her needs, and her mentor because "there just really wasn't a question that she couldn't answer or if she couldn't answer it then she figured it out or contacted the person that needed to be contacted to find it out or whatever she needed to do" (final interview, 5/31/2011).[6] Sophia succinctly described the instructional support

[6] While this quote from our final interview summarized the reasons Sophia found her mentor to be such a valuable support, it conveyed a transmission notion of "mentor" (i.e., Sophia had questions/needs; her mentor had answers/solutions). This was counter to the collegial exchange heard in Sophia's audio recorded mentor/mentee meeting. Since Sophia gave me just one audio recording, it stands to reason that

she garnered from her mentor and the district's online instructional resources: "A lot of the, the instructional techniques that I've found that I want to use have been either like through [the district's online instructional resources] or stuff that [my mentor] has shown me" (final interview, 5/31/2011). Ultimately, Sophia found the supports that served to scaffold and improve her classroom science instruction to be the most valuable. While other supports, such as PLC and the district's content-focused seminars, also provided levels of instructional support, Sophia did not find them as valuable perhaps because those supports were not as efficient or as readily accessible as her mentor and the district's online instructional resources. See Table 9 for a summary of the identities-in-practice afforded by and taken up during Sophia's induction supports as well as the meanings she made of each support.

Sophia's mentor and the district's online instructional resources served not only to scaffold and improve her science instruction, but were flexible and could be tailored to support Sophia's needs. Unlike supports that met at given times with given frequencies (e.g., weekly PLC meetings, weekly beginning teacher meetings, monthly content-focused seminars) or those that were spread across time (e.g., visits from Sophia's induction and support coach), Sophia could access these resources as needed for a range of topics, issues, and help that she deemed necessary. Rather than positioning Sophia as a beginning secondary science teacher who did not know what she needed, her mentor and access to the district's online instructional resources positioned and treated her as a

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this quote might be a better representation of her mentor/mentee meetings than the one audio recorded meeting I transcribed and analyzed.

budding professional more so that her other induction supports. They were also her most agentic supports.

Table 9. Summary of Sophia's Induction Experiences

Induction Supports	Beginning Science Teacher Identities-in-Practice: Afforded	Beginning Science Teacher Identities-in-Practice: Taken Up	Meanings Made
District-level supports	Orientation: As someone focused on policies and procedures Induction and success coach: As someone who needed positive feedback on her teaching	As someone who knew and followed policies and procedures; who sought something useful from supports and meetings	Orientation was a repeat of her teacher preparation program Induction and success coach was a cheerleader who did not offer feedback that made her teaching more effective
Mentor	As a colleague; a budding professional	As a novice who sought information from experienced mentor	Greatest support because she could get all of her questions answered
Beginning Teacher Meetings	As developing professional whose needs would change over course of school year; as someone who should be provided support for changing needs	As someone whose needs changed over time; as someone who gained something useful/beneficial from each support	Meetings with an instructional focus were more beneficial than those focused on procedures; at start of year, appreciated interactions with other beginning teachers

Table 9 (cont.)

Induction Supports	Beginning Science Teacher Identities-in-Practice: Afforded	Beginning Science Teacher Identities-in-Practice: Taken Up	Meanings Made
Colleagues and PLC	As someone focused on instructional planning and dividing tasks with colleagues	As someone focused on planning sequence of instructional topics and activities; as someone who shared and gained ideas; who divided work with colleagues	Recognized that her PLC was struggling to be a “true” PLC; PLC served a sharing, planning function she appreciated; division of work was helpful
Administrators	As someone able to ask for support and reinforcement needed to teach; able to ask for and get support with classroom management within limits	As someone who asked for and received disciplinary support to teach how she envisioned	Administrators were supportive, but within limits
Content-Focused Seminars and Online Resources	As someone who needed to learn more about best practices and effective teaching activities, but also as an instructional leader with valuable ideas to share; as someone who recognized the value of and needed content-focused support	As someone who gained from every support in which she participated; who saved time by accessing and modifying provided resources	Great support for effective teaching because resources could be modified to suit her students; eased the stress of her first year of teaching

While she found her mentor and the district’s online instructional resources to be the most impactful, she was provided a myriad of supports: district orientation, induction and success coach, mentor, induction coordinator, beginning teacher meetings, PLCs, colleagues, and additional "trainings." Sophia did not question the district's and school's expectations for her participation in these numerous supports. Such an overwhelming list of provided supports could indicate that the district and school took for granted that she and other beginning teachers would not know what they needed during their first year of teaching. As I write about this overwhelming list of supports in Chapter V, I recognize that this extensive list of induction supports could have made for a well-rounded and multifaceted network of induction supports for Sophia. This multifaceted aspect could have meant that if one support did not meet Sophia's needs, she had the option and opportunity to seek support from a different component of her support network (i.e., Bickmore & Bickmore, 2010). However, this was not the case. Despite being provided a myriad of supports, Sophia consistently mentioned two supports as most important: her mentor and the district's online instructional resources.

The induction supports provided to Sophia were consistent with those discussed in the teacher induction literature: Sophia's mentor was trained, well supported (Berry et al., 2002; Britton et al., 2002; Moir, 2005), and seemed to be purposefully paired with Sophia (Bartell, 2005; Johnson & The Project on the Next Generation of Teachers, 2004). With an assistant principal working closely with the school's induction coordinator and beginning teachers, the administration supported the goals of induction and those who assisted and mentored beginning teachers (Bartell, 2005). Likewise, participation in induction experiences, such as those Sophia was provided, were shown by Ingersoll (2006) and Smith and Ingersoll (2004) to be strongly linked to a reduction in migration or attrition after the first year of teaching. Based on multivariate analysis of SASS and TFS data from two recent cycles (1994-1995 and 2000-2001), the turnover rate for teachers participating is some induction activities, including subject-like mentoring, common planning, face time with school administrators, and beginners' seminars, was reduced from 41% for teachers receiving no induction to 27%. For teachers receiving full induction, which included the aforementioned activities as well as an external network, reduced teaching load, and a teacher's aide, turnover rate was reduced to less than half that of teacher receiving no support (Smith & Ingersoll, 2004). Of these levels of induction—none, some, and full—Sophia's induction experience was most similar to the middle level. She was assigned and regularly met with a subject-like mentor, was granted face time with school administrators, and attended weekly beginning teacher meetings. Though she planned with other earth/environmental science teachers at her school, they did not have a common planning period, instead meeting once a week before school.

Identities-in-Practice Enacted by Sophia while Teaching (Research Question 2)

Sophia's participation in and learning from her various induction experiences was evident in her classroom science teaching, as she incorporated elements from her additional "trainings," content-focused seminars, and mentor/mentee meetings. That Sophia incorporated elements from many of her induction supports into her classroom science teaching provided further evidence of her commonly enacted identities-in-practice: Not only was Sophia determined to glean useful information for all of her induction supports, but she put that information to use in her science teaching.

Sophia's teaching performances related to her induction supports. As Sophia recognized, she started off the school year with a rather laid-back and hands-off approach to classroom management (initial interview, 9/28/2010). This was evident in the ways she communicated expectations to her students. For example, at the start of each class, Sophia expected her students to respond to the bell ringer question that Sophia posted on the board prior to the start of class. Oftentimes, she did not remind or reiterate to students that they were supposed to do this bell ringer question at the start of class each day; thus, as the school year progressed, I observed fewer and fewer students answering these bell ringer questions.

To address this and other classroom management issues Sophia faced, her induction and success coach suggested that she attend a professional development workshop on proactive classroom management practices (final interview, 5/31/2011). One of the strategies Sophia learned during this professional development was to break down directions step by step. The importance of doing so to manage students' movement around the classroom became evident to Sophia during a lesson on point and non-point source pollution. During a lesson I observed, Sophia engaged her students in a demonstration of point and non-point source pollution. Students each picked a small item from their book bags or purses. Some students exchanged their items for ones Sophia provided. The students formed two lines representing rivers and passed their "pollution" downstream. Then, students were asked to identify their items that had collected downstream. This led to a discussion of point and non-point source pollution. Following this demonstration, students answered the essential question, why is it difficult to stop pollution, as their exit slip at the end of class (contact summary from observation, 12/14/2010). When asked about this lesson, Sophia commented that she had a “challenge with coordinating the students when I have them up and moving around” and attributed not being sure whether the concepts were clear to students to this management issue (interview, 3/11/2011). Though she gave directions step by step, Sophia still felt her coordinating of students’ movements could have been clearer.

Sophia also put into practice activities she gleaned from the district’s content-focused seminars. During the content-focused seminar I observed, Sophia and the participating earth/environmental science teachers engaged in an activity on point and non-point source pollution similar to the one Sophia included in her lesson. During the activity presented at the content-focused seminar, the participating teachers engaged in the ‘Sum of the Parts’ activity from Project WET (1995) in which they ‘developed’ a plot of land along a river. The finished plots of land were then assembled to form a river, and the teachers talked about how this activity could be used to talk about point and non-point source water pollution, with students using small objects to represent pollution and passing the ‘pollution’ downstream (contact summary of observation, 2/21/2011). Reflecting on her point and non-point source pollution lesson, Sophia drew on her experiences from the content-focused seminar to describe how she would revise her lesson in the future (interview, 3/11/2011). She discussed changing

> the lesson slightly so that I provide the pollution. I hope that will work a little bit better if I can control the balance between point and non-point source pollution. Next year, I think I’m going to do a different version of the lesson entirely where they draw pictures of water front properties and tape them together, then pass the pollution ‘down the river.’ (interview, 3/11/2011)

My interview with Sophia during which she reflected on her point and non-point source pollution lesson occurred following the content-focused seminar and took into account the instructional activities she learned about during the seminar.

The most influential professional development Sophia reported attending focused on literacy strategies (final interview, 5/31/2011). She described this professional development, which emphasized use of the textbook, as both “eye-opening” and “making complete sense” (final interview, 5/31/2011). As she explained, the main purpose of the professional development was “to teach [students] *how* to read the textbook,” a skill they would need in their future endeavors (emphasis added, final interview, 5/31/2011). From the literacy training, Sophia incorporated several strategies into her classroom teaching. I observed her incorporation of reading guides and “stump the teacher” in her teaching about planets.

During one lesson, Sophia gave her students a notes sheet about the moon. The notes were divided into three sections: physical features of the moon, phases on the moon diagrams, and solar and lunar eclipses. She instructed students to read through the first paragraph on the moon, to see how much they already knew, and to see whether they could guess the words that complete the sentences in the paragraph. Sophia explained to the class her rationale for having them do this:

> The reason you’re doing this is so that you are already thinking about what you need to look for and identify what you already know so that when you’re building neurons in your brain you’ve identified which ones you’re starting with so that you know where you’re going with them ‘cause learning actually changes your brain physically. (observation, 5/12/2011)

When it came to drawing the phases of the moon, Sophia "highly recommend[ed] looking at the picture and then trying to draw the phases without looking back. Try[ing] to process this information before you write it down" (observation, 5/12/2011).

After giving students ten minutes to work on their notes, Sophia regained their attention and engaged them in a whole class discussion of the notes. She made sure students had the correct information filled in the paragraph, and when discrepancies between students' answers arose, Sophia engaged them in a discussion of which answer was more appropriate. For example, the first sentence students filled in on the notes read, "The moon is a solid rock body that _______ around the earth." Students had supplied three different terms that could fill the blank: orbit, revolve, and rotate. As Sophia helped them to see, one response was more appropriate than the other two:

> *Sophia*: So, we have 3 different words. We have orbit, revolve, and rotate. Two of these words mean the same thing. One of them means something else. Which two of these words mean the same thing?
>
> *Student 1*: Orbit and rotate.
>
> *Student 2*: No, revolve and rotate.
>
> *Student 3*: Oh yeah, revolve and rotate . . .
>
> *Sophia*: So, what does it mean if I told you to get up and revolve around the room, what would that mean?
>
> *Sophia*: If I told you to get up and rotate around the room, what would that mean?
>
> *Class*: Turn and spin . . .
>
> *Sophia*: OK, so the moon does not rotate, well the moon does rotate, but it doesn't rotate around the earth. (observation, 5/12/2011)

Sophia engaged students in similar conversations throughout the notes to clarify vocabulary definitions. Likewise, in addition to having students diagram the phases of the moon based on their textbooks, she also discussed the phases and related vocabulary such as waxing and waning, repeatedly emphasizing the difference between waxing and waning and how to distinguish between the two when observing the moon (observation, 5/12/2011).

When asked about the lesson, Sophia discussed incorporating literacy strategies and activating students' prior knowledge. She wanted her students to be able to read and interpret their textbook, not only filling in the information on their notes but making predictions as well (interview, 5/13/2011). Sophia was explicit with students about her rationale for having them complete their notes in this particular way (observation 5/12/2011). Though some students were off-task during class, Sophia felt those who completed the assignment engaged in good discussions about the content with her and one another. In fact, it caught Sophia's attention when a small argument about the content broke out between students[7] (interview, 5/13/2011). When asked to think about teaching this same lesson in the future, Sophia discussed being more explicit in her rationale for having students take notes and use the textbook a specific way from the start of the school year. Additionally, she was interested in knowing whether this note-taking strategy was more or less effective than other strategies she employed during the school year (interview, 5/13/2011).

[7] This argument was inaudible from my position in the class. However, it excited Sophia that students were thinking and talking about the science content.

The following day, Sophia engaged students in a game of "stump the teacher" on earth's tilt, day and night, solstices, and equinoxes (observation, 5/13/2011). To play the game, Sophia assigned students a section of the textbook to read and instructed them to identify facts she might not know. After reading, students asked Sophia questions to try to stump her; for the next round, she asked them questions. Students' questions for Sophia included "What does a Foucault pendulum show?," "At the vernal equinox, where would the sun be in the sky?," and "Altitude is measured in what?" Sophia's questions to the students included "What is zenith?," "What is the summer solstice?," and "What is equinox?" For each question, discussion of the questions did not end until the correct answer was given. Following several rounds of "stump the teacher," Sophia gave the students "a little worksheet to reinforce what we've just done" (observation, 5/13/2011). Sophia circulated among the students, answering their questions and redirecting off-task behavior, while they finished the worksheet.

In describing the lesson afterward, Sophia explained that "stump the teacher" was another reading technique that allowed students to see and work with the information again (interview, 5/13/2011). Since students better understood the directions for and the point of "stump the teacher," Sophia observed that the game worked better this time than the last time she tried it; however, she still wondered whether this technique was more effective than others she had tried. For both the noting-taking technique used the previous day and "stump the teacher," Sophia was interested in knowing if the techniques were truly more effective in helping her students learn the information. Sophia discussed giving students a three-question check-up at the end of future lessons to gauge whether students were actually learning what she intended them to learn and thought they were learning from these techniques (interview, 5/13/2011).

Throughout our interviews, Sophia consistently talked about the invaluable support of her mentor and colleagues. In fact, much of the instructional support she received during her first year of teaching came from her mentor and earth/environmental science PLC (final interview, 5/31/2011). Although not during a lesson I observed, Sophia spoke of a time when her mentor helped her change a lesson between her honors earth/environmental science classes and her standard earth/environmental science class:

> Sitting at lunch with her [mentor] and the other science teachers and I said, I really don't want to do what I did in 2nd period in 4th period. It didn't really work very well in 2nd period and I don't really know what to do in 4th period. And she said, 'Hold on. I'll go get you something' and she went and tried to find something that she . . . had used before. Then she couldn't find it. So, she ended up going online, finding something, printing out copies, and bringing it to me at the beginning of class. (follow-up interview, 10/5/2010)

Along this line, Sophia repeatedly mentioned that her mentor was her most important support (initial interview, 9/28/2010; interview, 10/5/2010; final interview, 5/31/2011) because "she shared resources with me a lot" (interview, 10/5/2010). While I cannot say which of the instructional activities I observed Sophia use in her science teaching originated from her mentor, Sophia emphasized that her mentor was there

> resource-wise. Even though she doesn't teach earth and environmental right now, umm, once we got to, uh, atmosphere, meteorology, she's like, hey look I have these books . . . [M]y mentor already had stuff done. She's like 'this is what works . . . [T]ry this technique and if you want to do this then you can do that.' So, she had more ideas to offer than [PLC]. (interview, 5/31/2011)

Sophia's earth/environmental science PLC was another source for several of the instructional activities she used in her class. As previously discussed, Sophia appreciated the division of tasks that her earth/environmental science PLC enabled (final interview, 5/31/2011). For example, she and her PLC colleagues divided up the tasks of making unit reviews and unit tests (observation, 3/23/2011; observation, 5/11/2011). She also found it very useful to plan with her earth/environmental science colleagues and share resources (interview, 5/13/2011), frequently using resources and ideas she gained during PLC in her science teaching.

Summary/interpretation of identities-in-practice enacted by Sophia while teaching. As previously discussed with Research Question 1, many of Sophia's induction supports operated from a transmission model of induction and afforded beginning science teacher identities-in-practice accordingly. That is, Sophia's supports functioned to provide her with information, resources, and ideas, and she primarily accessed them for such. She approached her various induction supports with questions and/or wanting ideas and materials. Once she gleaned such, she was satisfied. Sophia frequently enacted beginning science teacher identities-in-practice as someone who sought and gained information from *all* of her various induction supports.

While her induction experiences provided opportunities to gain ideas, resources, and activities, Sophia's classroom science teaching provided opportunities for her to use what she gained, affording beginning science teacher identities-in-practice as someone who applied new ideas, resources, and activities to her classroom science teaching. Based on the identities-in-practice she enacted during her participation in induction, it should come as no surprise that Sophia took up these identities-in-practice afforded by her teaching, using many of the various ideas, activities, and resources she gleaned from her induction supports. The vignettes discussed above highlight many of the ways she accomplished this, using ideas, activities, and resources gained from her mentor/mentee meetings, content-focused seminars, and additional “trainings.” While demonstrating a conventional definition of support that is more technical (i.e., focused on what activities/techniques were known to work that Sophia could employ) than professional (i.e., focused on what would work best for her students and how she could adapt materials for her specific context), Sophia was determined to glean something useful from all of her induction supports.

Ingrid

Portrait of Ingrid

Like Sophia, Ingrid graduated from a traditional teacher preparation program at a four-year public university (student population 10,614) in the southeastern United States. She graduated with a degree in biology and was licensed to teach high school biology. The school system that employed her, however, petitioned the state to review her university transcript and award her comprehensive licensure. Though she prepared to teach high school biology during her teacher preparation work, Ingrid actually taught biology during the first semester and earth/environmental science during the second semester of her first year of teaching.

During college, Ingrid changed her major several times before ultimately deciding to become a high school biology teacher. She recounted that her love for science factored strongly into her decision: “I really enjoy science and I feel that, you know, not only do I enjoy teaching or coaching or whatever it is, but I’m pretty good at it so I thought it was a good fit” (initial interview, 10/18/2010). From the beginning of the school year, Ingrid was committed to helping her students succeed in school science, which meant helping her students succeed on the state’s standardized end-of-course (EOC) test. As she explained,

> I would just like to be a good teacher. I want my kids to pass. Umm, you know, I guess before I came into this school I really wanted kids to like science because I just have such a passion for science, but, umm, I have a different sort of view now that I’m at this school because we have a lot of lower performing students. I just want them to pass the EOC and graduate high school. (initial interview, 10/18/2010)

When I asked Ingrid what she meant by “good teacher,” she continued, “I think a good teacher is just someone who can relate to the students and get the information across; who can diversify lesson plans . . . Another big thing would be classroom management” (initial interview, 10/18/2010).

When Ingrid talked about her vision for science teaching, influences of the school’s priority status as a low performing school based on the state’s school report card system were evident. In fact, she defined success as a science teacher in accord with the school’s high-stakes testing environment:

> A successful science teacher, well, of course, people upstairs and in the suits always like to say numbers . . . Your data {laughs}. Umm, how many people pass, how many people fail. That’s how, that’s what we get judged on. So, although I don’t completely agree with that, I don’t think that numbers are everything, umm, that’s kind of how I have to think. (initial interview, 10/18/2010)

She continued to explain that she defined success as a science teacher based on day-to-day successes with her students. For example, she told the story of a student who typically did not understand the concepts she covered in biology until her classes were studying DNA replication, “you know A to T and G to C, he understood that and he could do it and he sat down and did all of his worksheets” (initial interview, 10/18/2010). Though she did not think this student would pass his biology EOC exam, she took satisfaction in that fact that “he finally understood one part . . . I could tell that he felt good about himself for those couple days where, you know, most of the time he . . . doesn’t know what’s going on and to me, that’s a success” (initial interview, 10/18/2010). Based on this personal definition, Ingrid defined the first three months of the school year as a success:

> I think that so far this has been a successful year. I mean my numbers aren’t great, umm. Not all the kids are getting it, but just seeing individually some kids, not even the whole time, not even general throughout this entire time they’ve been improving, but just for certain days they’ll sit down, they’ll do their work, and they’ll do a good job. Umm, so I think that, that’s a success. (initial interview, 10/18/2010)

Regardless of her own meaning of successful science teaching that celebrated students’ short-term successes and reflecting influences from the school’s testing climate and priority status, Ingrid gave in to the administration’s definition of successful teaching as the school year progressed. Toward the end of first semester when state EOC exams were soon to be given, Ingrid discussed feeling “forced” to define success in terms of her students’ passing rate on the EOC:

> From the administration in our building as well as from the [district] in general. Umm, you know, they, what they do when they get our benchmark scores, or EO, our mock EOC scores, is they put every, every teachers' score on a graph and for every, for each subject and then print it out and give it to every teacher in the school. So, for me, I'm being compared to, you know, all these other teachers in the school, and they put, they also put them up on the wall for all of the kids to see . . . And, you know, it's just, they really, really reinforce test scores and the test scores and the test scores and I understand why they do it because, you know, they're trying to, you know, they're getting attacked by the people above them. And, you know, it's all about the test scores, so. It's just kind of become, get the kids to pass the test and that's it. (follow-up interview, 1/11/2011)

During second semester, Ingrid taught earth/environmental science, a non-EOC course with content in which she was not necessarily interested (final interview, 5/12/2011). It was noteworthy that when Ingrid taught earth/environmental science second semester and was no longer under the pressure of the school's high-stakes testing culture, her definition of successful science teaching shifted again to align more closely with her original notions. As she explained at the end of the school year, "I think successful science teacher would be, umm, having an impact on the kids" (final interview, 5/12/2011). By "having an impact" on her students, Ingrid intended for them to view school positively: "You know, there's a lot of negative, umm, you know, thoughts when they come to school . . . I want them to, you know, feel better about being in the classroom and learning, because learning can be fun" (final interview, 5/12/2011).

While neither the administration's nor Ingrid's definition of successful science teaching was particularly deep, Ingrid's original focus of connecting with students through day-to-day successes remained evident as she reflected on the successes of her first year of teaching:

> I'm proud that, umm, I feel like the kids like my class for the most part, enjoy coming in. I mean, even the kids who acted like they hated my class last semester still come in here and bother me this semester, you know. So, I feel like they got something out of it. Umm. So, I guess that, that makes me, umm, glad 'cause there's, like I said, there's so many kids that just hate school that, you know, I just want them to at least like a little bit of it. (final interview, 5/12/2011)

As she recounted,

> I think it's been a good year so far. [Laughs.] It was hard. Umm, like I said before there was a lot of things that I could learn from, which is good to do things and say, oh that didn't work at all. [Laughs.] I need to do things differently next time. So, yeah, I mean, I think it was successful and in the end, umm, for last semester, I got half my kids through the EOC. Like I said, I wish I had gotten more. But, I didn't so that's fine. Umm, this semester I think I've, you know, helped the kids move along and grow a little more. So, I think that was good . . . I guess I just think it was a pretty good year. Pretty good year. It'll, it'll get better. I think, I think I learned enough from this year that I can do a better job in the coming years, and go from there. (final interview, 5/12/2011)

At the conclusion of her first year as a high school science teacher, Ingrid planned to move to Costa Rica. She was not planning to move because she disliked teaching; rather, she had studied abroad in Costa Rica and loved it there. She was unhappy in her current city and felt a bit stagnant. As she explained, "So, I know I'd be happier somewhere else," emphasizing "I love teaching and I don't want to leave teaching. That, that's not why I'm leaving" (final interview, 5/12/2011). In fact, her plan was to find a science teaching position at a bilingual school in Costa Rica.

Summary/interpretation of Ingrid's meaning of successful science teaching. Ingrid recalled that prior to the start of the school year she "really wanted kids to like science because I just have such a passion for science;" she also wanted "to be a good teacher" (initial interview, 10/18/2010). To Ingrid, a good teacher clearly related the content to students through differentiated lesson plans and practiced effective classroom management strategies. However, after being at the school for two months, Ingrid had “a different sort of view now that I’m at this school because we have a lot of lower performing students” (initial interview, 10/28/2010). Initially recognizing that others (i.e., school and district administrators) would define success as a science teacher differently than she did, over time Ingrid adopted the school’s definition of success—getting students to pass the state’s standardized end-of-course tests and graduate from high school. This shift in Ingrid’s definition of successful science teaching aligned with Bartell’s (2005) view that beginning teachers’ perceptions of teaching were shaped by several factors related to the context of their induction period, including school type, class size, workload, availability of resources, student characteristics, school climate, collegial relations, and parental involvement. Following Bartell’s (2005) argument, not surprisingly Ingrid, who taught at a historically low performing school with high minority student populations, adopted this mindset over a relatively short amount of time.

Ingrid’s Induction Experiences (Research Question 1)

Like Sophia, Ingrid attended the district orientation prior to the start of the school year, had access to an induction and support coach as well as a mentor, and attended beginning teacher meetings.

Toward the start of the school year, Ingrid expected to gain teaching ideas and resources she could use in the future from her various induction supports; however, she was not interested in putting such ideas into practice because she need to discover her teaching style and what worked for her during her first year of teaching:

> I would like to just get mainly ideas. The thing is is the stuff that we, when we do go to these things and we see how other people, you know, other ways, methods that teachers use in their classrooms and things like that and I think, oh what a great idea. I just don't want to use it yet because I don't know what works for me yet, and I don't want to try to put something in and, you know, end up that I'm not organized enough or I'm not focused enough . . . [T]his semester, I'm just trying to see what works for me and then after that try to implement other people's ideas . . . I like hearing those ideas, though. I like hearing how other people handle things . . . I mean, just resources more than anything. (initial interview, 10/18/2010)

On one hand, Ingrid hoped to gain teaching ideas and resources from her various induction supports; on the other hand, she intended not to implement the ideas and resources she gained, wanting first to figure out her own teaching style. This contradiction clouded nearly all of the induction experiences Ingrid attended: She attended knowing that she would not gain anything valuable. Frequently throughout her induction experiences, Ingrid took up beginning secondary science teacher identities-in-practice centered on an inability to apply resources and ideas from others to her own specific teaching situation and context. As I discuss below, the identities-in-practice Ingrid enacted during her induction experiences had implications for the meanings she made of her experiences.

District orientation, and induction and support coaches. Though Ingrid attended district orientation, she did not name it as a support when asked to describe all the ways she had been supported as a beginning teacher. Ingrid was asked this question three times throughout the school year, yet did not discuss district orientation once. She did, however, mention her induction and support coach. As Ingrid explained, her induction and success coach tried to be helpful, but Ingrid did not always agree with her suggestions: “[S]he has given me some really good ideas and then at the same time sometimes, I’m just kind of like, you know, she didn’t really help me” (follow-up interview, 1/11/2011).

Ingrid’s induction and success coach gave her some ideas that she found helpful but other ideas she did not. Given this, overall, Ingrid did not view her induction and success coach as a beneficial support primarily because “she gives me ideas, but a lot of them I’m kind of like, I don’t wan-, I either don’t want to do them or, you know, I don’t think it’ll work” (final interview, 5/12/2011). While Ingrid admitted that some of her induction and success coach’s ideas have been useful, “for the most part, I don’t know. She’s not really science-based so I don’t really think she knows what she’s talking about sometimes” (final interview, 5/12/2011). Despite these feelings, one useful idea Ingrid gained from her induction and success coach was to increase the font size on her notes so that students could see the notes from the back of the classroom without moving. This “kind of sort of gave me the idea in general that the least movement going on the better, you know” (final interview, 5/12/2011).

Summary/interpretation of Ingrid’s district-level supports. Similar to Sophia’s case, Ingrid’s district orientation afforded science teacher identities-in-practice focused on knowing and following policies and procedures. In fact, this was a primary emphasis during orientation, and Ingrid’s induction and success coach served to reinforce many of the topics discussed during orientation. The district orientation day devoted to curriculum and lesson planning also centered on knowing and following policies and procedures, and mainly emphasized adhering to the district’s pacing guide and accessing the district’s online instructional resources. Extending this focus on policies and procedures, Ingrid's induction and success coach provided strategies to better facilitate Ingrid's science instruction, affording identities-in-practice centered on technical aspects instruction and instructional improvements, such as managing student movement during lessons. Within the context of her district-level induction supports, Ingrid took up secondary science teacher identities-in-practice of skeptic. She was skeptic of advice from an "outsider" who was not familiar with her, her teaching style, and the school's context; and who was not a science teacher. Ingrid refused to consider, let alone try, many of her induction and success coach's suggestions.

Since Ingrid was skeptical of the advice her induction and support coach offered, it should come as no surprise that Ingrid ascribed little value to her district-level supports. Ingrid did not afford her induction and success coach much credit or respect, saying "I don't really think she knows what she's talking about" (final interview, 5/12/2011). Therefore, Ingrid did not try many of her induction and success coach's suggestions and did not seem to value the support her induction and success coach offered. She did not view them is directly applicable to her classroom or her instruction and failed to see the purpose of district orientation and her induction and success coach. If we were to follow this line of thinking, Heilbronn's (2004) stance that beginning teachers need to understand the role of their mentor and professional development was confirmed by Ingrid's feelings toward district orientation and her induction and success coach.

School-based supports. Though Ingrid did not explicitly mention the district supports as supportive of her as a beginning secondary science teacher, she did reference school-based supports, such as her mentor, as supportive.

Mentor. Ingrid met with her mentor, a biology and earth/environmental science teacher whose classroom was across the hall, whenever she saw fit, frequently walking across the hall to ask questions on an impromptu basis. Though they did not formally meet for thirty minutes each week as was required by the district, Ingrid and her mentor maintained communication. As she explained,

> I go over there almost every day and just talk to her . . . I'll just, you know, before class, before school starts, I'll just go over and say, ah, this is what happened yesterday and we'll just chat and sometimes during lunch I'll go over and talk to her and just see what kind of ideas she has. (initial interview, 10/18/2010)

Throughout the year, Ingrid maintained that she went to her mentor anytime she had questions. When it came time to complete the mentor/mentee log required by the school and district, "I would usually just flub it and take it over there and get her to sign it," rationalizing this because "if I didn't have questions there really wasn't a need for me to go over there and talk with her" (final interview, 5/12/2011).

Ingrid's interactions with her mentor centered on her questions, and she felt comfortable asking her mentor a range of questions

> just not about from teaching and reviewing, but also even, you know, like when I was sick, you know, this past week I asked her, like, should I wait for the school to figure out if school's closed or should I put in for a sub . . . [B]ecause she's been teaching here so much longer I can ask her different questions just about anything. (follow-up interview, 1/11/2011)

When Ingrid met with her mentor, she typically had specific questions in mind to ask. During one audio-recorded mentor/mentee meeting, Ingrid and her mentor spent the whole meeting focused on one of Ingrid's questions. In the weeks leading up to the state's standardized end-of-course biology test, Ingrid went to her mentor to learn how to best review with her students for the test.

> *Ingrid*: I've taught everything in biology. I feel like I've taught through [curriculum] goal 5, but I, umm, you know, have 3 days next week and I need to keep reviewing so they can be ready for the EOC 'cause they're not ready and I need to know how I can review.
>
> *Mentor*: OK. First thing you can do is give the kids either condensed sets of notes like we did last year, like all you need to know for 1.0, or all you need to know for 3.0. You can do it in the form of graphic organizers. Have them fill in the information again. Have them either use their notes or use a partner, and then that way it forces them to go back and rethink some of those topics and ideas, and then put that information down again. Whatever goal you're focusing on, at the end of the class give them an opportunity to review whatever graphic organizer they came up with . . . And then quiz them on it . . .
>
> *Ingrid*: In the same day?
>
> *Mentor*: In the same day, give them 3 or 4 EOC-style questions and see how they do on them, but make sure that they're goal specific whatever goal that you're covering that particular day.
>
> *Ingrid*: OK.
>
> *Mentor*: Umm, if you do 2 goals, then that's fine too. Another thing you can do is, I had the kids last year make posters and I will give them like [curriculum objectives] 3.01 and 3.03. Write down and draw pictures, illustrations, things that you might see on a test or you've seen on a test. Umm, different types of examples of questions. Things like that. Put everything you know about 3.01 and 3.02 on a poster and then display those posters in the room until the day of your exam.
>
> *Ingrid*: OK.

> *Mentor*: And have them refer to those notes, umm, if you play any type of bingo game with vocabulary, so that's a good way to review. (mentor/mentee meeting #1, 1/2011)

As her mentor discussed various ways to help her students review for the state test, Ingrid asked follow-up questions to help clarify the plan her mentor described. In addition to the poster review discussed above, Ingrid's mentor also detailed another review option using a clicker system.

Ingrid's mentor taught biology and earth/environmental science, and Ingrid drew on her mentor's knowledge of both. At the end of second semester, Ingrid finished teaching her earth/environmental science curriculum and had some extra time. Wanting to productively fill this time, Ingrid sought her mentor's advice on overlaps between the earth/environmental science and biology curricula she could spend time emphasizing.

> *Ingrid:* OK. Umm, I have a question on how to teach goal 5. I know that biology doesn't usually get the chance to teach it and I want to do it in earth/ environmental, so what would you recommend that I go over? How would I do it? How would I incorporate it?
>
> *Mentor*: Umm, when you look at goal 5, goal 5.01 is the one that's covered most heavily on the EOC. So, you're looking at symbiotic relationships. They have to know mutualism, commensalism, parasitism, and what's the other one? I think those are the only 3 that they test them on. But, if they know how those organisms interact. (mentor/mentee meeting #2, 5/2011)

Again, the topics of this mentor/mentee meeting revolved around specific questions Ingrid had for her mentor. In this case, her mentor continued to discuss content, such as biotic and abiotic factors and carrying capacity, that Ingrid could emphasize to help prepare her earth/environmental science students for biology.

Mentor/mentee meetings that focused on school policies and procedures, rather than instruction, were no different. Ingrid's mentor thoroughly answered the questions Ingrid brought with her to the meeting. In the example below, Ingrid went to her mentor with a question about final exams.

> *Ingrid*: So, I got an email saying that I needed to turn in a final exam to [the principal], and I didn't know if there was a common exam or if I needed to make up one. And, how do we go about doing that?
>
> *Mentor*: Oh, so you don't have to reinvent the wheel
>
> *Ingrid*: [Laughs]
>
> *Mentor*: A couple years ago we worked together as a team to develop a 200-question exam, and then we learned that when the kids took it, they bottomed out. You had to curve it so, so deep that it wasn't an accurate, umm, reflection of what they did. So, I went back and made another one that was kind of, kind of geared towards the curriculum that we actually taught, umm, and it only has, I think, 89 questions. So, it should take them a little more than an hour to take it, which is standard for taking a, umm, non-EOC. So, you can turn that one in. Umm, in addition to the actual test, there's a study guide that you can give the kids, umm, to prepare for the test, and it's, it's in line with the actual test. So, that should help out . . . Umm, give it to them at least 2 weeks before the exam. Umm, if you give them the study guide, you can also collect your books early because they don't need to keep their books at home to study because everything they'll need is on the, the study guide. So, that kind of kills two birds with one stone. And then, umm, you guys can turn in one copy of the exam with all of your names on it, and then [the principal] will know that that's the exam given for all of the earth/environmental science classes for this term.
>
> *Ingrid*: OK, so do I turn it into [the principal] or [the science department chair]? Or both?
>
> *Mentor*: I think they ask that you give it to your chair person, so give it to [the science department chair]. He should turn it in. That way you'll have proof that everyone had one. (mentor/mentee meeting #3, 5/2011)

Though they did not meet on a regularly scheduled basis (i.e., once a week for 30 minutes), Ingrid nonetheless found her mentor to be greatly supportive, stating that her mentor has "definitely been one of the best sources of information that I've got" (follow-up interview, 1/11/2011). That mentoring was one of Ingrid's "best sources of information" implied meanings of mentoring as a commodity (i.e., something of use) rather than a resource (i.e., a source of support) for professional growth; yet regardless of these implied meanings, Ingrid considered her mentor to be among her most important supports. In fact, when asked about the support that was most important or most impactful, Ingrid named her mentor, among other school-based supports. Recognizing the value of her school-based science coach, colleagues, and mentor, Ingrid explained that they all had "been really awesome. I mean, I can't pick one out of them because [my mentor] kind of helps me personally too" (final interview, 5/12/2011). Ingrid's only critique of the otherwise great mentor/mentee relationship was that she and her mentor did not have common planning, oftentimes making it difficult to find time to meet (final interview, 5/12/2011).

Summary/interpretation of Ingrid's mentor support. During our interviews, Ingrid consistently named her mentor as one of her most important supports. While one of Ingrid's mentor/mentee meetings focused on exam procedures for non-EOC subjects (mentor/mentee meeting #3, 5/2011), the other two centered on preparing students for the biology EOC. One such meeting at the end of first semester focused on preparing Ingrid's students at the time for their upcoming biology EOC (mentor/mentee meeting #1, 1/2011); the other meeting at the end of second semester focused on preparing Ingrid's earth/environmental science students for their biology classes next year and giving them a foundation in important biology information (mentor/mentee meeting #2, 5/2011). Ingrid's mentor/mentee meetings, then, afforded science teacher identities-in-practice focused on preparing students for EOC tests and knowing the state's curriculum well enough to do so. Focused primarily on addressing Ingrid's needs and questions, mentor/mentee meetings were also a safe space for Ingrid to ask questions and get answers. Dialogue between Ingrid and her mentor positioned her mentor as an expert whose purpose it was to answer a novice's questions during the mentor/mentee meetings. Ingrid's identities-in-practice during her mentor/mentee meetings were as a novice seeking information. Following a transmission-type model similar to Sophia's mentor/mentee meetings, Ingrid had questions and/or needed information, and her mentor had the answers and/or information she needed. Ingrid asked follow-up questions for clarification of her mentor's responses, but Ingrid never questioned, only accepted, the answers and information her mentor gave. Ingrid's mentor was one person from who she sought and accepted ideas and solutions.

Though Ingrid and her mentor did not meet on a regular basis for thirty minutes a week, the content of their mentor/mentee meetings was driven by Ingrid's needs and typically centered on questions related to procedures or her classroom instruction. Ingrid drew on the nearly instant access to her mentor for emotional support as well. As beginning teachers "deal with psychological stress, technical deficiencies and conceptual conflicts with the current norms and culture of teaching" (Wang & Odell, 2002, p. 533), the emotional and instructional support provided by mentors is critical (Villani, 2002).

Ingrid's mentor took time during the mentor/mentee meeting to thoroughly answer all of Ingrid's questions. While there was not much in the way of dialogue involving the exchange of ideas between mentor and mentee, Ingrid did engage her mentor by asking follow-up questions based on her mentor's responses.

Beginning teacher meetings. Similar to her mentor/mentee meetings, Ingrid's beginning teacher meetings occurred in an impromptu, unscheduled manner. Ingrid described her irregularly scheduled beginning teacher meetings as very brief sit-and-get meetings (final interview, 5/12/2011). As she explained,

> We usually show up, sign a piece of paper, [the school's induction coordinator] will talk to us for like three minutes, and then that's it . . . [T]hey're supposed to be planned ahead of time. But we'll just get an email sometimes, like 'meeting today.' What? (final interview, 5/12/2011)

Since Ingrid's beginning teacher meetings were held without much, if any, advanced notice, I was not able to observe her during this induction activity.

Summary/interpretation of Ingrid's beginning teacher meetings. Unable to observe any of Ingrid's beginning teacher meetings, I did not know the content of these "get it and get out" meetings (final interview, 5/12/2011). Ingrid reported that her beginning teacher meetings were brief and her attendance was required though little to no advanced notice was given. This structure for and approach to beginning teacher meetings afforded beginning teacher identities-in-practice that positioned Ingrid and other beginning teachers at her school as people who needed to be given information, regardless of how hastily that information was presented. Additionally, the approach to beginning teacher meetings positioned beginning teachers as school faculty who were not yet professionals. That is, it was acceptable to make last minute demands on beginning teachers' time and to have meetings on topics they did not find relevant to their classroom teaching. Similarly, Ingrid's beginning teacher meetings afforded beginning teacher identities-in-practice that conveyed that beginning teachers, as a group, were not important, as supporting the beginning teachers through regular, developmentally progressive meetings was not a priority of the school. During these hasty beginning teacher meetings, Ingrid enacted identities-in-practice that were skeptical of her support. As with her induction and success coach and other induction supports, Ingrid was skeptical that she could gain anything useful from her beginning teacher meetings. Anticipating that the beginning teacher meetings would not be helpful, Ingrid was annoyed when, in fact, she did not gain anything from the meetings. Without much, if any, advanced notice and seeming to Ingrid to lack purpose, beginning teacher meetings were not a significant support for her. Based on the limited information Ingrid told me about her beginning teacher meetings, I gathered that they were not developmental in progression (Berliner, 2001; Luft & Patterson, 2002) and did not necessarily meet Ingrid's needs as a beginning secondary science teacher.

Additional induction supports. In addition to the district- and school-based supports previously discussed, Ingrid discussed several other induction supports that went beyond those mandated by the state's beginning teacher support policies. These additional supports included colleagues and her professional learning communities, school-based and state science coaches, administration, students, and the district's content-focused seminars.

Colleagues and professional learning communities. At the start of the school year, Ingrid acknowledged the exchange of resources and ideas among her biology colleagues: "[F]rom the other biology teachers, I ask for worksheets and things, and they always give them to me. Umm, we're really good about sharing ideas and that sort of deal" (initial interview, 10/18/2010). Much of the collaboration Ingrid sought to foster was aimed at helping her students succeed on the state's EOC. Not only did Ingrid work with her biology colleagues, but she also sought assistance from non-science colleagues to help her students prepare for and pass the state biology EOC. She

> tried to get in contact with the English teachers to try to do a cross-curricular thing. I send them science articles, you know. Please teach these prefixes and suffixes. Fit them in somehow because they don't have an EOC yet in English. (initial interview, 10/18/2010)

Though not collaborative in nature (Ingrid asked her English colleagues to do specific things in their teaching, which they did not), Ingrid reached out to other teachers as she worked to prepare her students for the EOC.

In addition to seeking instructional resources from her biology colleagues, Ingrid also sought ideas for instructional improvement. She would discuss with other biology teachers that "my kids didn't get this. How do I reteach it? Or what kind of, umm, resources do you have for this goal? And they're very good at supplying me with whatever it is I need" (follow-up interview, 1/11/2011). When thinking about introducing and discussing various biology concepts, Ingrid was similarly interested in her colleagues' ideas to "figure out more, kind of, interesting things to tell my kids" (follow-up interview, 1/11/2011).

At the end of the school year, Ingrid maintained that her colleagues "have been great" (final interview, 5/12/2011). While Ingrid's biology colleagues were very helpful during her first semester of teaching, feeding her "all sorts of resources," she admitted that "there wasn't a lot of support for earth science," which she taught second semester (final interview, 5/12/2011). As she explained, she and the other earth/environmental science teacher had "gone in different directions because, you know, there's not an EOC. So, we're not exactly in the same place, umm, so I haven't been able to get a lot of resources from her" (final interview, 5/12/2011). Though Ingrid received little support from her earth/environmental science colleague, she would "go over and specifically ask [her mentor], you know, what should I do" (final interview, 5/12/2011) in earth/environmental science. Ingrid's mentor, an experienced earth/environmental science teacher, provided Ingrid with the support and resources she needed to teach earth/environmental science.

Not only did Ingrid engage with her colleagues one-on-one, she also collaborated with them during weekly PLC meetings. During the first semester, she attended biology and science department PLCs; second semester, she only attended the science department PLC.[8] Not only did Ingrid's biology PLC enable the exchange of ideas and resources, it also reinforced her confidence in her content knowledge: "I know the content in biology . . . [I]t's fairly simple and we just go down the middle. We get in our biology PLCs . . . These are the things the kids need to know, and that's what we teach" (initial interview, 10/18/2010).

[8] Since earth/environmental science was not a state-tested subject, there was no earth/environmental science-specific PLC.

At the end of the school year, Ingrid recounted that she found her biology PLC to be “very helpful . . . especially since I was beginning” (final interview, 5/12/2011). She discussed the general structure of her biology PLC meetings:

> We would get a little sheet that for each goal . . . and it would say, these are the following concepts that need to be taught. And then, attached to it would be a couple worksheets or, you know, activities, something about, you know, how to teach it. Some ideas. And we would go over pacing . . . [W]e would also talk about testing. When the testing would come up. Umm, the benchmarks, common assessments, and all that (final interview, 5/12/2011)

Biology and science department PLCs were both on Wednesdays, and frequently the science department PLC, which occurred after school, was largely a repeat of information from the biology PLC that occurred earlier in the day. Ingrid explained: “[W]e talked about all that and then we’d get to the science PLC and we’d just talk about the same stuff again” (final interview, 5/12/2011). Ingrid’s school-based science coach discussed the premise behind the school’s PLCs:

> PLCs at [this school] evolved over the 3 year period I acted as science coach. Originally, the PLC was more of a science department meeting followed by sharing of ideas, activities and strategies each teacher found beneficial. Then each discipline had a break-out session to discuss lesson plans for the upcoming week. The science coach was the lead figure. When we were able to convince the administration to give biology teachers the same planning period, PLC’s took on a different direction. From that point on the entire department met for department business . . . Each week a different teacher (including the science coach and an assistant principal) presented a strategy and/or activity to the others. The activities were tried out by other teachers, tweaked, critiqued and reported on at a later meeting. Teamwork abounded. Collaboration took off even stronger than before. The teachers became the lead figures. (interview with Ingrid’s school-based science coach, 5/30/2011)

During the second semester when Ingrid taught earth/environmental science, she found the science department PLC meetings to be "fairly useless" because "we usually just go over information for the EOCs, which I don't teach, or it turns into a gripe session" (interview, 5/17/2011). I observed one of Ingrid's science department PLCs that occurred a month into the second semester.

At the start of the PLC meeting, the school's science coach talked with science teachers about supplies they needed. As a department, they had $90 remaining on a grocery store gift card. During this discussion, Ingrid mentioned using balloons, straws, and Skittles candies in her class and having students bring back pencils and other supplies from the career fair to stock the classroom. Next, the school's science coach directed the topic of conversation to testing. Biology and physical science teachers recently administered their common assessments and the school's science coach hoped to discuss the results; however, the scoring machine was not working properly and the score reports were delayed. While teachers talked about the common assessments, Ingrid sat quietly. I inferred that since she did not teach a state-tested subject second semester, she did not actively engage in the conversation.[9] She did, however, participate in the discussion when a colleague talked about his strategy for helping students learn non-science words. Ingrid related having a student ask her what saliva was during state testing, a time when she could not answer the student's question. Teachers also discussed correlation between students' scores on the common assessments and their EOC scores. One teacher

[9] This inference was supported by Ingrid in our final interview when she stated that she felt the PLC meetings typically "didn't cover a lot of ground… They mostly focus on EOCs and this semester I don't have an EOC, so it doesn't concern me" (final interview, 5/12/2011).

highlighted that if students scored 50% or higher on the common assessments, then they should score at least at level 3 of 4, indicating consistent demonstration of mastery of the biology curriculum on the EOC; however, Ingrid had “plenty of kids score well on the [common assessments] and make 2,” indicating inconsistent mastery of the curriculum (observation, 2/23/2011). An assistant principal then talked with the science teachers about providing Saturday tutoring for their students. Though the teachers agreed with students’ need for additional tutoring, they were concerned that students would not choose to attend the Saturday sessions. Ingrid shared her own experiences of encouraging students to attend tutoring when the assistant principal mentioned providing snacks as incentives: “I did that a lot and had a pretty good turnout . . . I gave them apples because I don’t feel good about giving them bad food and I replace three low grades for each tutorial” (observation, 2/23/2011).

Ingrid’s participation became livelier when one of the biology teachers shared a transcription bingo game to review DNA processes. Teachers filled out their bingo cards with the names of amino acids. As the biology teacher began to call out DNA triplets (i.e., TCC, AAA), Ingrid joked with the department chair, who was a chemistry teacher: “You have to write [the base pairing rules] all down?” (observation, 2/23/2011). When the DNA triplet was called out, teachers transcribed it into a RNA codon, and then translated it into an amino acid, which they marked off on their bingo cards. All of the science teachers seemed to enjoy this and clapped for the biology teacher’s presentation. Such PLC meetings were the reason

> teachers in the . . . science department have been recognized for their genuine caring for each other. Each goes out of her way to help the other. There is a real sense of being part of a team and that *everyone* matters. They shared many ideas and took from each other. There is no sense of competition . . . They learned to ask for help when needed and trust each other. There is no 'back-stabbing.' (interview with Ingrid's school-based science coach, 5/30/2011)

School and State Science Coaches. Not only did the school's science coach lead the PLC meetings, she also supported Ingrid on an individual basis. When Ingrid was unsure of how to teach the vast biology curriculum while adhering to district pacing guides, the school's science coach "really cut it down for me, you know, and say, just go over this and this, and this is how you can do it" (follow-up interview, 1/11/2011). Likewise, Ingrid's science coach also provided "support for being able to inspire kids . . . [M]y fellow teachers are, you know, and the science coach come to me with interesting articles about science that I can share with, with the kids" (follow-up interview, 1/11/2011). Reflecting on the school year, Ingrid summarized the support she received from her science coach for both biology and earth/environmental science:

> [S]ometimes I'd be, like I don't know how to teach this. And she would sit down with me and go, OK this is how it's gonna be tested on the EOC . . . We need to, you know, teach it in this manner . . . So, she kind of showed me, laid it out like this is how you need to teach this as quick as possible. And I was like, OK. In earth science every once in a while she sat down with me and planned out a week of plans, of lesson plans with me, you know. Start with this, go to this, because she knows I was new and was not really feeling earth science. So, she helped me out a lot with that too. (final interview, 5/12/2011)

Due to the school's priority status with the state's Department of Public Instruction, a state-level science coach was also assigned to Ingrid's school. Similar to her induction and success coach, Ingrid did not find the state science coach helpful:

> We also have another lady who comes in . . . [S]he's always asking me, 'How can I help you? How can I help you?' And she really just kind of, I mean I hate to say it, but she just kind of wastes my time . . . [S]he comes in during my planning and I'm trying to get things done and she wants to sit and tell me about, you know, this popsicle stick thing that she's told me 100 times before. And I'm just, OK I'm not doing that. (follow-up interview, 1/11/2011)

Summary/interpretation of Ingrid's supports from her colleagues, PLCs, and science coaches. Ingrid's PLCs afforded identities-in-practice focused on instructional planning and using common assessment data to inform instructional decisions. Secondary science teachers were simultaneously positioned as needing to continue to gain new ideas and resources while also being positioned as sources of such new ideas and resources. In Ingrid's biology and science PLCs, she and other science teachers were afforded identities-in-practice of instructional leaders who could help one another tweak, critique, and improve instructional activities. Similarly, within the context of PLC, science teachers were positioned as collaborative team players, and everyone in the PLC was viewed as important to the PLC. During biology PLC meetings and in her interactions with colleagues, Ingrid took up identities-in-practice that positioned her as a novice seeking information. Again, following a transmission concept, Ingrid viewed her colleagues as sources of answers and information: Other science teachers had things (e.g., ideas, resources, activities) Ingrid wanted or needed, she asked them, and they gave. During science PLC meetings, Ingrid took up identities-in-practice that positioned her as a passive attendee with little to gain from the science PLC meetings, which were either repeat of her biology PLC meetings during first semester or not relevant to her as a non-EOC teacher during second semester. Since Ingrid positioned herself as a getter of information instead of an instructional collaborator during PLC meetings, she did not take up the promoted identities.

Similar to interactions with her mentor, Ingrid sought instructional support from her colleagues and school-based science coach as well. Weekly PLC meetings were the time and space for much of the exchange of ideas and resources that Ingrid greatly valued. In fact, along with her mentor, Ingrid named these school-based supports—her science coach and colleagues—as most important and impactful, saying that she

> can't pick one out of them because [my mentor] kind of helps me personally too . . . [My school science coach], she's always checking in on me and helping me out. And then my colleagues, they definitely, the science department is pretty close and, you know, if you ever need something, you know someone would cover your class. You can call them in a heartbeat. It's no problem. (final interview, 5/12/2011)

These supports that Ingrid found so important were school-based (Johnson & The Project on the Next Generation of Teachers, 2004) and focused on supporting her personally and professionally (Villani, 2002; Wang & Odell, 2002). Ingrid's school-based induction experiences aligned with Johnson and the Project on the Next Generation of Teachers' (2004) description of deliberately school-based induction programs: Induction supports, such as mentors and PLC meetings, were integrated into the professional life and practice of the school, and PLC meetings used and developed local professional capacities of the science department by having each science teacher share an activity.

In contrast to the support provided and identities-in-practice afforded by Ingrid's PLCs and school-based science coach, the state science coach offered identities-in-practice that suggested teachers at priority schools needed more help and support than other teachers in order to successfully teach their students. As in her interactions with other supports, Ingrid enacted skeptical identities-in-practice when interacting with the state science coach. She did not want to be bothered by the state science coach, believing that she did not want and could not gain support from everyone and/or everything that was provided. Iterative with the identities-in-practice afforded by the state science coach's support, the skeptical identities-in-practice taken up by Ingrid led to her perceiving support from the state science coach as unhelpful and a waste of her time. The state science coach, who infrequently visited Ingrid and offered, in Ingrid's opinion, irrelevant advice, was not perceived by Ingrid to be a significant support.

Administration. As previously discussed, Ingrid's administration's meaning of successful science teaching engulfed her own during the first semester when she taught biology, a state-tested subject. When asked about her meaning of successful science teaching, Ingrid's initial response was "of course, people upstairs and in the suits always like to say numbers. Your data [laughs]. Umm, how many people pass, how many people fail. That's how, that's what we get judged on" (initial interview, 10/18/2010). Though Ingrid did not personally agree with this marker of successful science teaching, she relinquished, "that's kind of how I have to think. You know, I have to think, I'm getting judged on how many of my kids are passing, how many of them are failing. And that's it" (initial interview, 10/18/2010).

Although Ingrid adopted the administration's view of successful teaching, she did not perceive much support from the administration in accomplishing this goal. Ingrid recalled situations in which one of her science colleagues completed and submitted discipline referrals for several students only to have “nothing happen” (initial interview, 10/18/2010). Similar administrative inaction occurred when “administrators have walked into his classroom while the . . . whole class had just erupted and they walked in and then left, and didn’t do anything. Didn’t pull kids. Didn’t take them to ISS. Didn’t write any kids up” (initial interview, 10/18/2010). In fact, Ingrid was “warned actually not to tell any administrators if I’m having behavioral problems because they’ll take it to the principal and then the principal will say that I can’t control my classroom” (initial interview, 10/18/2010).

Even toward the start of the school year, Ingrid wanted more support for behavioral and disciplinary issues from her administration (initial interview, 10/18/2010). This want continued throughout the school year. While she felt “fairly well” supported during her first semester of teaching, Ingrid thought her administration could be more visible and supportive (follow-up interview, 1/11/2011). Likewise at the end of the school year, students’ misbehaviors where challenging for Ingrid to manage and she did not perceive much support from the administration (final interview, 5/12/2011).

Students. As previously discussed, when the pressures of EOC testing were removed, Ingrid’s meaning of successful science teaching shifted from an emphasis on students’ EOC scores to focus on the positive impact she wanted to have on students. In describing the “positive impact” she hoped to have on students, Ingrid explained that she wanted her students to “feel positive about coming into the classroom . . . [K]ids hate school because they hate coming here and hate being in the classroom. I want them to, you know, feel better about being in the classroom and learning, because learning can be fun" (final interview, 5/12/2011). She wanted to have "a positive impact on [students] and, you know, them leaving, you know, feeling good about how they did in school this semester. You know, feeling good that they learned something and they've improved. That they've made progress" (final interview, 5/12/2011). She discussed her students as a support for helping her realize this vision of successful science teaching. As she explained,

> I can feed off them when I'm seeing that they're enjoying something or that they're doing it and doing a nice job. And that encourages me to want to not do boring lessons, to try to come up with better things. (final interview, 5/12/2011)

Of the beginning secondary science teachers participating in this study, only Ingrid and Whitney mentioned their students as supports; neither of them did so until their final interviews.

Summary/interpretation of Ingrid's supports from administration and students. The support (or lack thereof) that Ingrid received from her administration afforded beginning science teacher identities-in-practice focused on students' EOC scores: Successful, effective teachers had high EOC passing rates and their students achieved high EOC scores. Teachers were expected to get their students to demonstrate mastery on the EOC with scale scores of 3 or 4 with limited instructional or disciplinary support from the administration, thus transforming the afforded identities-in-practice from someone with high EOC scores to someone who can get their students to achieve on the EOC without pestering the administration. Early in the school year, Ingrid took up identities-in-practice that recognized how she was judged as an effective teacher. Though she did not fully share the administration's view of successful science teaching, she took up identities-in-practice that assimilated the administration's view of successful science teaching. Ingrid's identities-in-practice, then, were three-fold: Not only did she take up beginning science teacher identities-in-practice as someone who recognized how she was being judged as an effective teacher, but she also took up identities-in-practice as someone who assimilated authority's (i.e., the administration) ideas with her own and who came to define successful teaching as having high EOC passing rates.

While research established that administrators should be present, positive, and actively engaged; anticipate the needs of beginning teachers; maintain orderly schools; support classroom management (Johnson & The Project on the Next Generation of Teachers, 2004); and support the goals of induction and those who assist and mentor beginning teachers (Bartell, 2005), Ingrid overwhelmingly perceived a lack of support from her administration. In fact, she was warned by colleagues not to discuss her classroom management concerns with administrators for fear the administration would cast her in a negative light. This view of the administration as focused primarily on test scores and unsupportive of teachers could have potentially negative consequences since the conditions in which beginning teachers work "affect their ability to teach well and the satisfaction they derive from their work" (Johnson et al., 2005).

Interactions with Ingrid's students afforded beginning science teacher identities-in-practice centered on being a fun and exciting teacher and using students' reactions to gauge whether lessons and activities were fun and exciting. When testing pressures were removed for Ingrid during second semester and her focus shifted to positively impacting students, Ingrid took up identities-in-practice as a beginning secondary science teacher who attended to the types of instructional activities to which students did and did not respond well. Additionally, she enacted beginning secondary science teacher identities-in-practice as someone who wanted her students to think of school as a positive experience. To accomplish this, she aimed to make learning fun, rather than boring, for her students. Though Ingrid did not feel supported by her administration, it is remarkable that, as a first-year teacher, she discussed her students as a source of support. Typically beginning teachers' concerns initially centered on themselves rather than their students and students' learning (Fuller, 1969). Though Ingrid's discussions of her vision for science teaching and the support she received from her students were not focused on student learning and understanding per se, it is nonetheless noteworthy that she recognized her students as key players in what she perceived as a successful first year of teaching.

Content-focused seminars. Though Ingrid appreciated and valued the exchange of ideas and materials among her colleagues during PLC meetings and in conversations with her school science coach, she did not perceive the ideas and materials shared during the district's content-focused seminars to be relevant and applicable to her teaching. During first semester, Ingrid attended monthly biology-focused seminars; second semester, she attended monthly earth/environmental science seminars. Reflecting on the support she gained first semester from the content-focused seminars, Ingrid stated "that [it] is occasionally helpful. Usually it's above the level of my students so I can't really apply it to my students, umm, but I can sometimes get good ideas, I guess, from the other science teachers there" (follow-up interview, 1/11/2011). On a later occasion she elaborated:

> I went to three biology [content-focused seminars] last semester and didn't use anything from any of them. Again, the presentations are either for small classes, or very focused classes . . . These [seminars] have absolutely no impact on me whatsoever except that they take up my time.[10] (interview, 2/22/2011)

Toward the beginning of second semester, Ingrid attended the same earth/environmental-focused seminar that I previously describe in Sophia's case. During this seminar, teachers participated in several instructional activities: ocean facts activity, "Sum of Parts" from Project WET (1995), and two ocean currents activities (observation, 2/21/2011).[11] Though Ingrid participated during the seminar, she had limited interactions with other teachers. She completed the activities as asked of her and was supportive of the teachers who shared the activities, clapping at the end of their activity presentations. When working on the ocean currents activity, Ingrid approached it as a student needing to quickly complete the task. She worked through the activity for a while, but stopped before completing it. After trying the activity and hearing nearby teachers discuss it, Ingrid felt it would be too difficult for her students to complete (contact summary for observation, 2/21/2011). In fact, Ingrid

> found the [seminar] completely useless. I cannot do any of the activities they mentioned. Most of the time these sessions are for higher performing students then the ones I have. The activity took too much time and too much prior

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[10] As discussed in Chapter III, the district's content-focused seminars were not officially part of the state's and district's beginning teacher support policies; however, the beginning teachers were expected by their school to attend.

[11] See Sophia's case for a full description of these activities.

> knowledge was needed. Even the other worksheets passed out were at a reading level too high for my students . . . The only thing I might use is the design of a world where each student 'develops' a piece of land. I would have to modify it though. (interview, 2/22/2011)

Though Ingrid felt the activities presented during the content-focused seminar were too advanced for her students, she took care to stress that she did not have low expectations for her students: "I in no way expect less out of my students. I know they all have to learn the same material. But the abstract thinking and planning and previous knowledge that goes into these activities are too much" (interview, 2/22/2011). Ingrid recognized that the content-focused seminars were intended to be supportive; however, she overwhelmingly viewed them as a waste of her time (final interview, 5/12/2011). She maintained, "this is my first time in earth/environmental science and I wish that these sessions could be more helpful. They definitely have the potential to be extremely worthwhile, but as of yet they have not been" (interview, 2/22/2011).

Summary/interpretation of Ingrid's supports from the district's content-focused seminars. The identities-in-practice afforded by the district's content-focused seminars that Ingrid attended were two-fold. In the seminars, science teachers were positioned as needing to learn more about best practices and good instructional activities for teaching earth/environmental science, yet the earth/environmental science teachers throughout the school district were the sources of such practices and activities. During the content-focused seminars, earth/environmental science teachers were afforded identities-in-practice as someone who needed to be shown or given effective teaching resources while also being positioned as instructional leaders with opportunities to share instructional resources and ideas, and receive recognition for their ideas.[12] As with several of her induction supports, Ingrid took up skeptical identities-in-practice during the district's earth/environmental science -focused seminars. She was skeptical about whether the information, resources, and ideas presented during the seminars were actually applicable to or useful in her teaching context with her particular students. Her skepticism was primarily due to the fact that most of the seminar presentations took place at and were made by teachers from schools of distinction or schools of progress; none where from priority schools like Ingrid's.

Due to her skepticism and the disconnect Ingrid perceived between the teachers presenting at the content-focused seminars and their schools and classrooms compared with her own, Ingrid found the seminars of "no help," saying they had "no impact" on her teaching (interview, 2/22/2011). In fact, Ingrid claimed the content-focused seminars impacted her only by taking up her time; she did not gain anything she felt would be useful in her earth/environmental science instruction (interview, 2/22/2011). Emphasizing that "most of the time these sessions are for higher performing students then the ones I have," but recognizing that she could use some of the activities presented if she modified them (interview, 2/22/2011), Ingrid seemed to want activities, resources, and ideas that she could get from the content-focused seminars and use in her teaching without modifying them; *that* was what she would have found useful and beneficial (rather than a waste of her time).

[12] Again, not all earth/environmental science teachers shared activities, resources, and ideas during the content-focused seminars. The district's secondary science curriculum specialist selected which teachers would present during the seminars.

Once under the impression, though, that the activities, resources, and ideas presented during the content-focused workshops were not for her or her students, Ingrid was quick to dismiss the presentations. She seemed heavily influenced by her perceptions of her school and students compared with the schools and students of the teachers presenting at the earth/environmental science seminars. As previously discussed, Bartell (2005) established that beginning teachers' perceptions of teaching were shaped by several factors related to the context of their induction period. Among these factors were student characteristics and availability of resources. Since Ingrid perceived incompatible differences between her students and teaching context and the students and teaching contexts of those who presented at the content-focused seminars,[13] it should come as no surprise that she overwhelmingly felt these seminars were irrelevant, inapplicable, and a general waste of time.

Support from the district's Enrichment Region. As a priority school, the high school where Ingrid taught was part of the school district's Enrichment Region. Most of the district's five regions were arranged geographically; however, the Enrichment Region consisted of nine schools (3 elementary, 3 middle, and 3 high schools) from across the district that needed intensive support.[14] Each region held meetings for the teachers, students, and parents in that region. One such Enrichment Region meeting that Ingrid found particularly useful occurred toward the end of first semester and focused on preparing students for the state's EOC exams. As she explained, she and other biology

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[13] Typically the content-focused seminars were held at schools recognized by the state as schools of progress or schools of distinction. Additionally, advanced placement teachers sometimes presented activities at these seminars.

[14] http://www1.gcsnc.com/regions/enrichment/index.htm

teachers from across the Enrichment Region "could review what we call power objectives for the biology EOC. And that really, really helped me a lot. Umm, it gave me a lot of really good ideas" (follow-up interview, 1/11/2011).

Unlike the teaching activities and resources shared at the district's content-focused seminars, Ingrid used the activities she gained from the Enrichment Region meeting in her science teaching. For example, "for reviewing like cell organelles . . . I put up, umm, little cards on the board and did organelles and their definitions and different cell parts and their definitions and had kids match 'em up. That was a really great idea" (follow-up interview, 1/11/2011). She also received review worksheets that she could give to her students. An important distinction that emerged between the teaching activities and resources from the district's content-focused seminars and those shared at the Enrichment Region meeting was that Ingrid could immediately use the EOC review activities presented during the Enrichment Region meeting without adapting or modifying them: "[E]verything they went over they gave it to us in the folders that we can make copies of it right away. We didn't have to go online and look things up or anything like that. So, that was very helpful" (follow-up interview, 1/11/2011). Additionally, the teachers presenting the EOC review activities during the Enrichment Region meeting taught at schools similar to Ingrid's. Each school in the region was identified as needing "intensive support" from the school district; therefore, Ingrid perceived more relevance and applicability to the activities and resources shared at the Enrichment Region meeting than during content-focused seminars. In fact, she maintained that "definitely the Enrichment Region EOC thing" was more helpful than the content-focused seminars because "the stuff they have [at the content-focused seminars] is just difficult for my students. I don't think my students would get through it" (follow-up interview, 1/11/2011).

The Enrichment Region meeting afforded science teacher identities-in-practice that celebrated the professional capabilities and capacities of teachers proven to be successful within the region; it positioned successful teachers (i.e., teachers with high EOC passing rates) from the region as professionals with valuable instructional resources and ideas to share despite their teaching context (i.e., at priority or low performing schools). Successful teachers' EOC review resources were presented to other teachers in the Enrichment Region in ready-to-use, teacher-proof ways. Conversely, the Enrichment Region EOC meeting afforded science teacher identities-in-practice as someone who should focus heavily on EOC scores and who needed additional (and proven successful) help and support for promoting student achievement on the EOC. As a beginning science teacher within the context of the Enrichment Region EOC meeting, Ingrid took up beginning science teacher identities-in-practice focused on getting directly applicable and ready-made support, ideas, and resources for helping her students review for the biology EOC. This context did not afford beginning science teacher identities-in-practice focused on Ingrid's agency or creativity as a teacher.

Summary/interpretation of Ingrid's induction experiences. Of the induction experiences Ingrid has access to as a beginning secondary science teacher, she most greatly valued her school-based supports: her mentor, colleagues, and school science coach. Ultimately, Ingrid found these people to be important sources of support because they were familiar with her teaching context, relevant to what she aimed to accomplish in her classroom, and always available and accessible. See Table 10 for a summary of the identities-in-practice afforded by and taken up during Ingrid's induction supports as well as the meaning she made of each support.

Table 10. Summary of Ingrid's Induction Experiences

Induction Supports	Beginning Science Teacher Identities-in-Practice: Afforded	Beginning Science Teacher Identities-in-Practice: Taken Up	Meanings Made
District-level supports	Orientation: As someone focused on policies and procedures Induction and success coach: As someone who needed general strategies to facilitate instruction	As someone who was skeptical of advice from an "outsider;" who refused help from someone outside of her school and content area	Did not give induction and success coach much credit and thought she did not know what she was talking about; did not try most of her ideas or value the support she offered
Mentor	As someone focused on preparing students for EOC exams; who knew standard course of study; who turned to mentor (an expert) with questions	As a novice who sought information/answers from her mentor; who was comfortable with transmission model of support	Mentor was source of answers for procedural and instructional questions; provided emotional support
Beginning Teacher Meetings	As someone who needed information regardless of hasty presentation; who was not yet a true professional; who it was not a true priority to support in this manner	As someone who was skeptical that she could gain anything from the meetings; who was annoyed by the infrequent and last minute nature of the meetings	The "get in, get out" beginning teachers meetings were rushed and pointless

Table 10 (cont.)

Induction Supports	Beginning Science Teacher Identities-in-Practice		Meanings Made
	Afforded	Taken Up	
Colleagues and PLC	As someone focused on planning and using data to inform instructional decisions; as needing to continue to gain new ideas, but as having new ideas to share with colleagues; as instructional leaders	As novice who sought information from others (focused on transmission of information); as passive participant	Helpful to a beginning teacher because they "feed her all sorts of resources"
Science Coaches	School: As someone who was an instructional leader and collaborative team player State: As someone who needed more help/support than other beginning science teachers because she taught at a priority school	School: As a novice who sought information and help from science coach State: As someone not to be bothered because she was not interested in gaining ideas; as skeptical that support would be applicable	School: Beneficial as another source of information/answers; helpful in planning and deciding on critical information to teach for each objective State: Not helpful at all; wasted time by repeatedly offering the same ideas/solutions
Administrators and Students	Administrators: As someone whose students had high EOC passing rates; who should be able to achieve high passing rates with little support/input from administration Students: As someone who should be exciting and not boring; who could use student reactions to know if their lessons and activities are on target	Administrators: As someone who recognized how her success as a teacher would be judged by the school; who assimilated administrators' definition of successful teaching Students: As someone who wanted her students to think of school positively; who planned activities to make learning fun, not boring	Administrators: Felt support from the administrators was lacking; wanted more support for classroom management Students: Focused on fun, but was not focused on student learning and understanding per se

Table 10 (cont.)

Induction Supports	Beginning Science Teacher Identities-in-Practice: Afforded	Beginning Science Teacher Identities-in-Practice: Taken Up	Meanings Made
Content-Focused Seminars	As someone who needed to learn more about best practices and effective teaching activities, but also as an instructional leader with valuable ideas to share; as someone who recognized the value of and needed content-focused support	As someone skeptical of whether the information presented would be applicable to her context	Of no help and had no impact on her teaching; information could not be used in her specific context without first being modified

Ingrid's preferred beginning science teacher identities-in-practice centered on a transmission model of support. That is, she had questions and needs as a first-year science teacher and her school-based supports (i.e., her mentor, colleagues, and school science coach) held the answers and solutions. All Ingrid had to do was ask. Therefore, she approached and accessed these supports only for ideas, rarely coming to PLC and mentor/mentee meetings ready to share ideas of her own. This approach to receiving induction support was most evident in Ingrid's mentor/mentee meetings. She and her mentor met whenever Ingrid had questions and it was a convenient time for them to spend a few minutes talking.[15] Ingrid started the meetings by asking a question; her mentor offered and detailed her ideas and solutions for the remainder of the meeting. Once Ingrid had satisfactory answers or solutions, the mentor/mentee meetings ended.

[15] Ingrid reported that she and her mentor did not meet the expected 30 minutes weekly. The total time Ingrid met with her mentor during the 3 audio recorded mentor/mentee meetings she submitted was 20 minutes and 53 second. The average mentor/mentee meeting length was 6 minutes and 58 seconds.

Ingrid's adopted transmission model of support aligned with promoted beginning science teacher identities-in-practice of her mentor support and was enabled by her colleagues; however, the transmission-centered beginning science teacher identities-in-practice Ingrid frequently enacted countered the beginning science teacher identities-in-practice afforded by PLC. Ingrid's mentor support afforded beginning science teacher identities-in-practice as someone who was familiar with the state's science curriculum and focused on preparing students for the state's biology EOC exam. During mentor/mentee meetings, Ingrid's mentor positioned herself and was positioned by Ingrid as an expert; Ingrid, then, held the dichotomous position of novice. Ingrid's interactions with her colleagues afforded beginning science teacher identities-in-practice as someone focused on planning and using assessment data to inform instructional choices. In the contexts of her mentor/mentee meetings and interactions with colleagues, Ingrid was allowed (i.e., not held accountable for doing otherwise) to enact transmission-centered beginning science teacher identities-in-practice: Her mentor always answered Ingrid's questions during mentor/mentee meetings until Ingrid was satisfied with the answers. Both her mentor and her colleagues always provided the ideas, activities, and resources she requested.

Science PLC meetings, however, afforded beginning science teacher identities-in-practice that pushed beyond a transmission model. In the context of science PLC meetings, Ingrid and other science teachers were positioned by the school science coach and one another as continually needing to gain new ideas while simultaneously being sources of new ideas for one another. The science teachers were instructional leaders who could help one another improve their science instruction. While these afforded science teacher identities-in-practice extended transmission-centered identities-in-practice that Ingrid typically enacted, Ingrid positioned herself as someone at the science PLC meetings wanting to get information rather than wanting to be an instructional collaborator. She rejected the afforded science teacher identities-in-practice and instead enacted narrower identities-in-practice.

Though Ingrid was provided with supports discussed in the literature (Bartell, 2005; Britton et al., 2000; Ingersoll, 2003; Johnson & The Project on the Next Generation of Teachers, 2004; Villani, 2002), some of her supports, particularly the infrequent beginning teacher meetings held with little advanced notice, were not conducted in ways advocated for in the induction literature. Given this, it should come as no surprise that Ingrid did not assign value to many of the induction supports she experienced. In fact, Ingrid rarely took up identities-in-practice that allowed her to make meaning of or find value in anything (i.e., support, materials/resources, ideas) that was not immediately and obviously applicable to her teaching context. If she could not apply her various induction supports (and the accompanying ideas, materials, and resources) with little to no revisions or modifications, Ingrid did not find the support worthwhile, valuing technical forms of support over professional ones.

Identities-in-Practice Enacted by Ingrid while Teaching (Research Question 2)

Unlike Sophia, Ingrid's participation in and learning from her induction experiences was not readily evident in her classroom science teaching. Though she attended and participated in induction experiences as expected by her school and district, there was a disconnect between Ingrid's induction and her science teaching practice, further evidencing her positionality as someone who knew what was and was not applicable and relevant to her context and who did not want her time wasted with inapplicable or irrelevant things.

In our interviews, Ingrid reported that her teaching was influenced by her mentor, PLCs, and school science coach. Ingrid talked with her mentor "almost every day," asking instructional or procedural questions, or seeking emotional support (initial interview, 10/18/2010; follow-up interview, 1/11/2011; final interview, 5/12/2011). During one mentor/mentee meeting, Ingrid asked her mentor how to best review for the EOC. One of her mentor's suggestions was to have the students create posters pertaining to specific curriculum goals and objectives: "Give them like [objectives] 3.01 and 3.03. Write down and draw pictures, illustrations, things that you might see on a test or have seen on a test . . . [T]hen display these posters in the room until the day of your exam" (mentor/mentee meeting #1, 1/2011). As evidence by a lesson I observed during which Ingrid's biology students created such review posters in preparation for a practice EOC (observation, 12/15/2010), this mentor/mentee meeting was presumably not the first time Ingrid discussed reviewing content with her mentor (mentor/mentee meeting #1, 1/2011).

Much of the observed class was devoted to reviewing content and helping students prepare for the practice EOC. To start class, students worked on a bell ringer quiz that covered a range of topics: cell structure, osmosis, and protein synthesis. After the bell ringer quiz, Ingrid discussed and reviewed notes on natural and acquired immunity. Then, students used their textbooks to complete a chart comparing and contrasting viruses and bacteria. The remainder of class was devoted to creating EOC review posters (observation, 12/15/2010). As Ingrid explained her to students,

> So what we're gonna do is I'm gonna give you all that a, that big white piece of paper, just like we've done before and make these great review posters, which I think really helped you all last time. Okay, but you've got to make it about everything we've talked about. Okay. Your mock EOC is tomorrow, so I suggest you pull out all your old notes and go over it with the people at your table . . . Okay, so each table is gonna get a poster. I'm gonna print something out so that you all can see everything we need to remember. But take out your notes. Write down the things you might not remember tomorrow and I'm gonna post them around the walls. Okay. You are only allowed to look at the poster that you helped make. Okay. You're only allowed to look at the poster that you helped make, so make sure it is good and informative. (observation, 12/15/2010)

Of the nine times I observed Ingrid's science teaching, this was the only time I observed her incorporate ideas from her mentor/mentee meetings into her teaching. However, as previously noted, Ingrid reported drawing heavily on the instructional support her mentor provided (initial interview, 10/18/2010; follow-up interview, 1/11/2011; final interview, 5/12/2011). Similarly, Ingrid reported that her classroom science teaching was influenced by her PLC meetings and school science coach (initial interview, 10/18/2010; follow-up interview, 1/11/2011; final interview, 5/12/2011). She defined such influence as providing her with materials and teaching resources, and helping her with sequencing and on-target explanations; however, I did not directly observe such influence during my visits to Ingrid's classroom.

Summary/interpretation of identities-in-practice enacted by Ingrid while teaching. Given that during her participation in induction supports Ingrid frequently enacted beginning science teacher identities-in-practice centered on a transmission model of support and rarely took up identities-in-practice that enabled her to make meaning of or find value in anything that was not immediately and obviously applicable to her context, it should come as no surprise that a disconnect existed between Ingrid's induction supports and her classroom science teaching. With many of her supports, Ingrid was skeptical that she could gain anything important, applicable, or relevant that she could use in her classroom teaching with little to no revision. This skepticism related to relevance and applicability was highlighted when Ingrid discussed the supports that influenced her teaching: her mentor, colleagues, and school science coach, all supports provided in the context of her school. Though Ingrid's induction supports afforded beginning science teacher identities-in-practice centered on gaining information, ideas, and resources and her teaching had the potential afford identities-in-practiced focused on putting such information, ideas, and resources to use, Ingrid ultimately took up identities-in-practice that aimed to put into practice a narrow set of information, ideas, and resources; that is, only those gained from her mentor, colleagues, and science coach who worked and taught in the same context (i.e., same priority school) as she. From the start of the school year, Ingrid recognized the challenges that came with working at a priority school. The distinction between priority schools like Ingrid's and other, higher-performing schools coupled with the realities of teaching in one context as opposed to the other made Ingrid skeptical of the information, ideas, and resources she learned about from supports other than those that were school based. From each of her induction supports, Ingrid seemed to want ideas, resources, and activities she could use without modifying. She would have found that more helpful than what she actually received, and perhaps in seeing an applicability and relevance would have been more likely to implement such in her classroom science teaching.

Jessica

Portrait of Jessica

Unlike the other beginning secondary science teachers in my dissertation, Jessica was working toward her master's degree in education at the time of the study. A year prior, she graduated from a four-year public university (student population 21,306) in the southeastern United States with her bachelor's degree in biochemistry. Jessica completed her education coursework, some chemistry content courses, and her student teaching prior to accepting her first job as a high school chemistry teacher; she continued to work on her remaining content courses during her first year of teaching.

Jessica became interested in teaching high school science after teaching a general chemistry laboratory section on her college campus. She also had a friend, a lateral entry English teacher, who liked teaching and helped increase Jessica's interest in the teaching profession. Prior to starting her master's program, Jessica looked for lateral entry teaching positions in the local school system; however, there was a hiring freeze at the time and she instead decided to apply to graduate school.

While working on her master's degree in science education, Jessica participated in her university's Robert Noyce Teacher Scholarship Program as both a summer intern and a scholar. For her summer internship, Jessica served as a teacher's assistant for a middle school science teachers' professional development course. She worked with a faculty member from the Department of Chemistry and Biochemistry to develop hands-on chemistry activities, which they presented to the workshop participants. During her scholarship year, Jessica served as a laboratory instructor for a general chemistry laboratory section. Additionally, she participated in several Noyce cohort activities during her scholarship year. As project coordinator at the time, I planned and conducted the Noyce cohort activities in which Jessica participated. These activities included attending the state's science teacher conference (11/19/2009, 11/20/2009)[16] and the regional Noyce conference (3/26/2010, 3/27/2010); visiting and becoming familiar with community resources that supported science teaching such as the local natural science center (11/5/2009) and major biological supply company (11/6/2009); and observing excellent science teaching in a variety of contexts such as high-needs schools and middle/early colleges (11/13/2009, 2/17/2010 respectively).

Based on her teacher preparation and university experiences (initial interview, 11/4/2011), Jessica envisioned that her students would always be engaged in her science teaching. She thought her science classes needed "to be inquiry based and, umm, my goal is to keep students engaged at all times. So, you know, even when there's content that they're probably gonna view as boring, I try to keep it as interesting as possible" (initial interview, 11/4/2011). To Jessica, being a successful science teacher meant having "my students to leave the class interested in science . . . [and] to have gone away with a passing grade" (initial interview, 11/4/2011). Having her students pass the course and leave having learned something about science persisted as part of Jessica's vision and

[16] These dates indicate when Jessica participated in the particular Noyce cohort activities.

meaning of a successful science teacher. At the end of the school year, she explained that she was successful as a science teacher if

> the student walks away with some scientific knowledge . . . I just want them to walk away with something . . . To be prepared for college. Like, just how to write a lab report for instance. I mean, I really want to prepare them for college basically is what. ‘Cause most of the kids in [honors chemistry] are college-bound. (final interview, 5/17/2011)

Reflecting on her first year as a high school chemistry teacher, Jessica discussed feeling good about the work she had done. She recognized that she was “more independent [second] semester than I was last semester. I don’t have to really get as much help” (final interview, 5/17/2011). When asked about her biggest success during her first year as a teacher, Jessica reiterated that she felt good about the year as a whole: “I just think as a whole it’s gone well, I guess” (final interview, 5/17/2011). She cited her colleagues as her greatest support and discipline as her greatest challenge. In fact, the most important lessons she learned as a beginning teacher concerned classroom management (final interview, 5/17/2011).

At the conclusion of her first year as a high school science teacher, Jessica planned to return to her school again the following year. She welcomed the opportunity to start over again the next year with new students (final interview, 5/17/2011).

Jessica’s Induction Experiences (Research Question 1)

Like Sophia and Ingrid, Jessica attended district orientation, where she first met her induction and success coach, was assigned a mentor, and attended beginning teacher meetings. Since the nature of supports provided by the district orientation and the induction and success coach were previously described in Chapter III, I do not repeat those topics here. Instead, I focus on Jessica's engagement with these and other induction supports. As she started her first year of teaching, Jessica hoped to gain "probably better classroom management strategies . . . would probably be the main thing that I take away or would hope to take away from those [supports]" (initial interview, 11/4/2010).

District orientation, and induction and support coach. Though she attended all three days of district orientation, Jessica did not specifically identify orientation as a support when asked to describe all the ways she had been supported as a beginning teacher. Despite the fact that orientation did not register with Jessica as a support, the induction and success coach she first met while at orientation did. As Jessica explained, her induction and success coach visited every two or three weeks to make sure that her professional file was up to date. As part of the teacher evaluation system, she and other beginning teacher across the state "have to keep everything, all this documentation of everything we've done. She's been coming a lot the last couple of weeks to make sure that our folders are complete and that we have everything we need on our checklist" (final interview, 5/17/2011). Though Jessica reported that her induction and success coach visited every two or three weeks, our final interview was the first time Jessica mentioned her as a support (final interview, 5/17/2011).

Summary/interpretation of Jessica's district-level induction supports. As with Sophia and Ingrid, Jessica's district-level induction supports afforded beginning teacher identities-in-practice as someone who was focused on knowing and following policies and procedures. An emphasis on policies and procedures carried over into the supports provided by Jessica's induction and success coach. Her induction and success coach afforded beginning teacher identities-in-practices as someone who maintained up-to-date professional files. Within the context of her district-level induction supports, Jessica took up the promoted identities-in-practice. She enacted identities-in-practice that positioned her as a policy and procedure follower and a compiler of complete and up-to-date professional files with all of the proper paperwork signed by the proper people.

Prior to our final interview when I asked Jessica to describe all the ways she was supported as a beginning teacher, she did not discuss her induction and success coach. With policy- and procedure-oriented identities-in-practice afforded by her district-level induction supports and taken up by Jessica, it was not surprising that Jessica did not thoroughly discuss her induction and success coach's support until the end of the school year when the coach helped Jessica compile and finalize her professional file for teacher evaluation purposes. Similarly, Jessica did not mention district orientation when I asked about the various ways she was supported. She discussed and appreciated the support she received from her induction and success coach toward the end of the school year when the induction and success coach's purpose was clear: to assist Jessica and other beginning teachers in compiling their professional files. Alternatively, it was possible that Jessica simply forgot about orientation and her induction and success coach, who she initially met at the beginning of the school year, because she was inundated with so many other "supports."

School-based supports. While a primary support Jessica received from her induction and success coach focused on the completion of her professional file, she likewise had school-based supports to help her with her file and other professional matters.

Mentor. Like Sophia, Jessica reported meeting with her mentor for thirty minutes each week. Jessica found the weekly mentor/mentee meetings to be “good because, you know, random questions pop up all the time” (follow-up interview, 3/2/2011). However, in three audio recorded mentor/mentee meetings, Jessica only initiated questions on six occasions. Her questions concerned end-of-year policies and procedures, and scheduling for the upcoming school year (mentor/mentee meeting #1, 4/4/2011; mentor/mentee meeting #3, 5/5/2011). Rather than coming to the mentor/mentee meetings with questions for her mentor, Jessica typically answered questions about and discussed topics predetermined by her mentor. Their topics of conversation were generally procedural and included whether Jessica was being observed in accordance with the state’s teacher evaluation system; and how frequently and in what ways she communicated with parents. When instructional issues were discussed, Jessica and her mentor focused on topics such as tutorials, review strategies, and classroom management. Jessica and her mentor rarely discussed Jessica’s reflection on her science instruction or ways in which she could improve her instruction. As Jessica explained,

> We meet a minimum of 20 to 30 minutes and sometimes it’s longer. They have mentor meetings and then, so, we discuss what they discuss at the meetings and then she’ll, you know, check up on me, ask me what I’ve done that week, and, you know, have I had any issues in class with any of the students, and she’ll help me out if I have any issues. (initial interview, 11/4/2010)

Jessica's mentor frequently checked with her to gauge whether she was up to date with her professional file. Though Jessica received this type of help from her induction and support coach, her mentor monitored her in this aspect as well.

> *Mentor*: And, uhh, paperwork. You've got a lot of end-of-the-year paperwork . . . for [beginning teacher meeting] stuff, and for [your induction and success coach], or whatever . . . Have you started on that?
>
> *Jessica*: Yeah. She came by the other day, and, umm. Mostly my logs are pretty up to date. Professional log. The mentor log. Umm. I just have to go through and make sure you've signed everything. I need to get it organized, but everything is pretty up to date.
>
> *Mentor*: Yeah. And I need to sign your [professional development plan] as well.
>
> *Jessica*: Yeah. I printed out my second one. We had our post-, we had our conference the other day. Me and [the principal]. Yeah (mentor/mentee meeting #2, 4/7/2011).

In addition to reminding Jessica about her professional file, her mentor also made sure to celebrate Jessica's successes. For example, Jessica and her mentor discussed the principal's praise of Jessica as well as her upcoming graduate school graduation. Their conversation continued:

> *Mentor*: [The principal] speaks very highly of you . . .
>
> *Jessica*: Yeah, he told me he didn't think I was a first year teacher. I was like, aww that's a good thing, right?
>
> *Mentor*: Yeah. [laughs] You're doing really well. You really are. You really got your stuff together. That's good. (mentor/mentee meeting #2, 4/7/2011)

Jessica's mentor talked with her about her professional file and teacher evaluation paperwork, classroom discipline, upcoming school events, grade reports, communication with parents, and end-of-year policies and procedures (mentor/mentee meeting #1, 4/4/2011; mentor/mentee meeting #2, 4/7/2011; mentor/mentee meeting #3, 5/5/2011; final interview, 5/17/2011). Additionally, Jessica's mentor reinforced criteria to which teachers in the school where held accountable. For example, Jessica and her mentor discussed Jessica's use of data charts to track class progress on common assessments. Aside from talking about the need to have data charts and how to create them with colored tape instead of markers, Jessica and her mentor did not discuss ways Jessica could incorporate these data charts into her teaching (mentor/mentee meeting #2, 4/7/2011). Jessica was further held accountable for having up-to-date data charts when administrators and the science department chair completed five minute walk-throughs.

While school policies and procedures were typically discussed, reflection on teaching practices rarely was. Though Jessica's mentor asked whether she was reflecting on the school year and her instruction from semester to semester, Jessica's response was thin, demonstrating a limited degree of reflection. Her mentor's response did little to encourage deeper reflection:

> *Mentor*: Do you find yourself reflecting a lot comparing last, comparing like your teaching style last semester to this semester?
>
> *Jessica*: Yeah. I mean, there are things, I mean, I've done a lot of different stuff just from last semester. Like, just, you know, as far as like my lessons and the rules I set in my class and, I mean. It's better definitely. And I think next year will be even better than it is now. [Quietly laughs.]
>
> *Mentor*: Oh, yeah. My second year I think still was like my best year ever.
>
> *Jessica*: Yeah. (mentor/mentee meeting #1, 4/4/2011)

Of the beginning secondary science teachers in this study, Jessica was the only one to be assigned a mentor outside of her licensure area. Her mentor was an art teacher. Though she wished she had been assigned a mentor in her content area, Jessica felt that "aside from the content, I've gotten everything else that I've needed. She's been great. She's been there [at the school] a long time. She knows, you know, she knows the ropes I guess you would say" (initial interview, 11/4/2010). Despite being assigned a mentor outside of her licensure area, Jessica's mentor "helped me with a lot of things . . . [S]he's an art teacher, so not really with curriculum. But just things that I need to make sure and get done . . . [S]he's always got things that she's just checking up on" (final interview, 5/17/2011). Along with her chemistry colleague's support during collaborative planning meetings, Jessica found her mentor to be one of her greatest supports (final interview, 5/17/2011). In fact, the support she received from her mentor and chemistry colleague worked in tandem. As she explained,

> I would not want the other chemistry teacher as my mentor because he's great for collaborative planning as far as the content, but I like an outsider's point of view [from my mentor]. I like her for that and the chemistry teacher for what he helps me with . . . the curriculum, lesson plans, and activities he's been doing. (interview, 3/16/2011)

Summary/interpretation of Jessica's mentor supports. The support Jessica received from her mentor afforded beginning science teacher identities-in-practice focused on general instruction and support, necessitating a separation of instruction and science instruction, support and support for effective science teaching because of her mentor's content area (art rather than science). This implied meanings of induction and support that were divorced from beginning teachers' content areas (Luft, 2003, 2009; Luft et al., 2003, 2007; Luft & Patterson, 2002; Patterson et al., 2003; Roehrig & Luft, 2006). Additionally, with an emphasis on general, rather than science-focused, support, Jessica's mentor support afforded identities-in-practice centered on awareness of rules, policies, and expectations, with Jessica's mentor frequently reminding her of these. Despite repeated focus on knowing rules, policies, and expectations, Jessica's mentor support did not necessarily promote beginning teacher identities-in-practice as someone who followed *all* rules, policies, or expectations. In practice Jessica's mentor support actually afforded beginning teacher identities-in-practice that implied a need to follow only *some* rules or expectations. For example, while Jessica and her mentor were expected to meet 30 minutes each week, each of the audio recorded mentor/mentee meetings Jessica submitted averaged 13.5 minutes.[17]

As called for in the induction literature (Berry et al., 2002; Britton et al., 2000; Moir, 2005; Villani, 2002), mentors at Jessica's school were trained and well supported by the induction coordinator, meeting with her weekly to discuss the topics they should review with their mentees (initial interview, 11/4/2010). With a persistent focus on "checking up on" Jessica and reminding her of procedures and expectations such as professional files and data charts (final interview, 5/17/2011), Jessica's mentor support was overwhelmingly mentor driven. That is, Jessica's mentor, rather than Jessica, came to the meetings with a list of topics she intended to discuss. These topics were based on

[17] Mentor/mentee meeting #1 (4/4/2011) was 16 minutes and 40 seconds long. Mentor/mentee meeting #2 (4/7/2011) lasted 8 minutes and 18 seconds. Mentor/mentee meeting #3 (5/5/2011) was 15 minutes and 48 seconds.

mentors' meetings with the school's induction coordinator. This practice implied a top-down approach to mentor/mentee support and took for granted beginning teacher identities-in-practice as someone who did not necessarily know the areas or topics for which she needed or wanted help, advice, or support.

Though assigned a mentor outside of her licensure area (North Carolina State Board of Education, 2010; for discussion of strategically pairing beginning teachers with mentors, see Bartell, 2005 and Johnson & The Project on the Next Generation of Teachers, 2004), Jessica's mentor provided her with procedural information about the school and general support. Jessica accepted and took up promoted beginning teacher identities-in-practice as someone who was aware of and typically followed such rules and expectations. In addition to enacting identities-in-practice focused on needing help with and reminding of policies, procedures, and expectations, Jessica also enacted beginning science teacher identities-in-practice that emphasized management and student behavioral issues instead of science teaching and learning. Jessica approached her first year of teaching and engaged with the supports she was provided during her first year as though she mainly needed help with and support for management issues (initial interview, 11/4/2010): She accepted the fact that her mentor could not offer science-specific supports because that was not the area in which she needed support. Additionally, Jessica seemed to enact beginning science teacher identities-in-practiced that implied she was accepting of, or at least complacent in, the mentor- driven, top-down nature of her mentor support. During the approximately 41 minutes of audio recorded mentor/mentee meetings that Jessica submitted to me, she only initiated the topics of conversation or asked questions on six occasions.

Though Jessica's mentor was not a science teacher and much of the support she received from her mentor focused on policies and procedures, Jessica named her mentor as one of her greatest supports (final interview, 5/17/2011). She appreciated the general induction support that her mentor provided, acknowledging that her mentor's support paired well with the science-specific support her chemistry colleague provided during their collaborative planning meetings (interview, 3/16/2011). However, in disaccord with the mentoring literature (Bartell, 2005; Villani, 2002; Wang & Odell, 2002), Jessica's interactions with her mentor did little to promote significant reflection on her teaching practices, perhaps because mentors generally do not recognize standards-based teaching as an important goal of learning to teach, nor do mentors see mentoring impacting beginning teachers learning to teach (Wang & Odell, 2002). This disconnect between the action of the mentor and beginning teachers learning to teach could be exacerbated by having a mentor outside of her licensure area. Beginning teachers should, after all, understand the role of mentors and professional development during their induction years (Heilbronn, 2004). Likewise, beginning teachers should understand how to engage in reflection (Heilbronn, 2004), a skill that should be fostered through mentor/mentee interactions (Bartell, 2005; Heilbronn, 2004; Villani, 2002; Wang & Odell, 2002).

Beginning teacher meetings. Along with Sophia, Jessica was provided regular monthly beginning teacher meetings by her school's induction coordinator. Jessica described her beginning teacher meetings as "open discussion basically" (interview, 5/9/2011) during which she and the other beginning teachers asked questions and, along with the induction coordinator, helped one another to answer their questions. In fact, the school's induction coordinator purposefully set up the meetings to encourage such interactions: "[T]hey come in and they usually sit and just chit-chat. They want to say something that has happened, something about a kid . . . [T]hey tend to have a really good time with group discussions" (interview with Jessica's induction coordinator, 1/5/2011). She considered the meetings a success when she saw and heard evidence of the beginning teachers' supportive interactions: "To have the rapport with the other teacher[s]. For me, I think the success is listening to them, umm, talk and listen to each other and to think a little bit about what they're doing" (interview with Jessica's induction coordinator, 1/5/2011).

For two of the three beginning teacher meetings I observed, the desks were arranged in a circle and at each seat the induction coordinator placed candy and small classroom supplies such as dry-erase markers, and bulletin board border and decorations. During the January meeting, the induction coordinator talked with beginning teachers about snow days, optional teacher workdays, and annual leave time; exams and the exam schedule; grade recovery and make-up time for students' absences; and final grades (observation, 1/5/2011). Though the induction coordinator had an agenda for the meeting, she left many of the topics of conversation open to the beginning teachers and their concerns. To end the meeting, beginning teachers reflected on their first semester and thought about changes they would like to make for the new semester. Since the school followed a block schedule, the new semester marked a new start—new classes with new students. Jessica aimed to make her word wall more interactive in the upcoming semester because "now it just sits there" (observation, 1/5/2011).

During the April meeting, the induction coordinator talked with beginning teachers about classroom management, substitute plans, and grading. She also allowed beginning teachers to raise their own concerns, many of which centered on classroom management and consistent enforcement of rules and policies across the school (observation, 4/14/2011). The May meeting was a Cinco de Mayo celebration for beginning teachers and their mentors (observation, 5/5/2011). During the beginning teacher meetings I observed, Jessica was an active participate, engaged in discussions, asking questions, and answering her peers' questions. She seemed well informed of the various events and schedules occurring in the school (observation, 1/5/2011; observation, 4/14/2011).

Jessica gained "sort of the same thing as I get from my mentor" from her monthly beginning teacher meetings (final interview, 5/17/2011). She recounted garnering mostly procedural support from her beginning teacher meetings: "I've gained just general knowledge, like about the school itself and like about procedures. Little things that you, I mean little things that they don't tell you . . . and you know you're not sure about" (interview, 5/9/2011). Since the beginning teacher meetings mirrored her mentor/mentee meetings, Jessica determined that the beginning teacher meetings were "not really valuable because my mentor, I mean I can get whatever I need from my mentor" (interview, 5/9/2011). Because "the mentors meet and like the [induction coordinator], like she'll every week will say, here are some things make sure and bring up with your mentee this week," Jessica considered that "the things I've gotten from [the beginning teacher meetings] I also could have gotten from my mentor" (interview, 5/9/2011). Therefore, she felt there was no need to meet monthly as a group.

When asked whether she gained in any way from interacting with the other beginning teachers at the meetings, Jessica admitted "sort of, but see I interact with a lot of them anyway" in both social and professional ways (interview, 5/9/2011). She advised the Junior Civitans club with another beginning teacher and would sometimes "go to [other beginning teachers] with questions first just to see if they know before I go to someone else" (interview, 5/9/2011). Several beginning teachers adopted Jessica's homework credit card, a system for checking and giving credit for students' completed homework. Likewise, she gained ideas from her peers (interview, 5/9/2011).

Summary/interpretation of Jessica's beginning teacher meetings. Jessica's induction coordinator valued supportive dialogue among beginning teachers during monthly beginning teacher meetings. Given this, Jessica and other beginning teachers were afforded beginning teacher identities-in-practice as someone who was free to ask questions of and receive input and feedback from other beginning teachers and the induction coordinator. Likewise, Jessica and her school's other beginning teachers were afforded identities-in-practice centered on providing one another with answers or input based on their own experiences. During the beginning teacher meetings, the induction coordinator positioned the beginning teachers as having valuable ideas and experiences to share and from which others could learn. A duality of beginning teacher identities-in-practice was evident: Not only did beginning teachers need support, but they could also provide support to one another; they could ask questions as well as answer questions asked by other beginning teachers. In this context centered on open conversation and sharing, Jessica took up the promoted beginning teacher identities-in-practice as someone who both asked and answered questions. She enacted identities-in-practice as someone with valuable knowledge, ideas, and experiences to share. Similarly, she took up beginning teacher identities-in-practice as someone who was well informed of and willing to share her knowledge about school schedules, policies, and procedures.

Beyond promoted identities-in-practice, Jessica also enacted beginning teacher identities-in-practice as someone who did not necessarily need or benefit from the beginning teacher meetings. She recognized that she could get the same type of support somewhere or from someone else, namely her mentor. Therefore, she acknowledged that there was no true need for her to formally meet in a group with other beginning teachers and the school's induction coordinator. Jessica was not afforded nor did she take up beginning teacher identities-in-practice specifically related to science teaching.

While none of the beginning secondary science teachers in this study participated in specifically science-focused induction programs (Luft, 2003; Luft et al., 2003, 2007; Luft & Patterson, 2002; Patterson et al., 2003; Roehrig & Luft, 2006), Jessica's beginning teacher meetings were responsive to the needs of the school's beginning teachers (Luft & Patterson, 2002). Jessica's induction coordinator strived to foster a learning community among beginning teachers through the interactions she encouraged. This learning community became the context of beginning teachers' development throughout the school year (Hammerness et al., 2005). Within the context of monthly beginning teacher meetings, Jessica received procedural support (interview, 5/9/2011) similar to the support she received from her mentor (final interview, 5/17/2011). Because the nature of support she received from her mentor and beginning monthly teacher meetings was so similar, Jessica did not find the beginning teachers meetings beneficial: She received similar support from her mentor and still interacted socially and professional with other beginning teachers outside of the monthly meetings.

Additional induction supports. In addition to the district- and school-based supports previously discussed, Jessica engaged in other induction supports beyond those called for in the state's beginning teacher support policies. These included her colleagues and collaborative planning meetings, professional learning community, and administration.

Colleagues and professional learning community. Of her colleagues, Jessica maintained that "everyone's really helpful. Like, I can go across the hall or next door and ask anyone a question and they'll help me with anything" (follow-up interview, 3/2/2011). She found her colleagues in the science department to be "very generous. They've given me, you know, basically everything that they use. Umm, not that I've used all of it, but they have been really helpful, very generous" (initial interview, 11/4/2010). Collaborative planning was an important initiative at her school, so Jessica met with her chemistry and earth/environmental science colleagues, respectively, twice a month to plan (initial interview, 11/4/2010). During collaborative planning meetings, Jessica and her chemistry colleague planned upcoming units, scheduled major activities and labs, and discussed common assessments (final interview, 5/17/2011). Some departments had strict expectations for collaborative planning, but as Jessica explained “sometimes we use common assessments. Sometimes we don’t even do that. But, we are always teaching the same thing” (follow-up interview, 3/2/2011). Jessica’s colleague, who had taught chemistry for at least two years, led the collaborative planning meetings. Though Jessica offered ideas and activities “here and there,” her chemistry colleague “had sort of everything planned out and the way it works here is that you sort of follow. They want you to teach in similar ways . . . using like the same type activities and things like that” (final interview, 5/17/2011).

Though not part of the formal induction program, but rather expected of all teachers in Jessica’s school, Jessica repeatedly named her collaborative planning meetings, particularly in chemistry, as her most important support (follow-up interview, 3/2/2011; final interview, 5/17/2011) because she was able to “talk to the other chemistry teacher every day about what we’re doing that day. Umm, you know, asking him questions. He never seems annoyed” (initial interview, 11/4/2010). In fact, Jessica’s chemistry colleague helped her “a lot. He gave me basically everything he had and, like, was willing to. And now, like [second] semester, I’m doing a lot of things differently ‘cause I’m like on my feet now and I have, you know, a semester under my belt” (follow-up interview, 3/2/2011). Admittedly, Jessica “got a lot of help with [chemistry] last semester”; however, second semester, she received a little less help from collaborative planning “because I didn’t necessarily need it, not just because he didn’t offer it” (final interview, 5/17/2011).

Unlike other participants who met weekly with science and subject-like PLCs, Jessica's PLC meetings occurred twice a month during her planning period, and were school- rather than department-wide. All teachers, regardless of content area, with a common planning period participated in the same PLC. Typically, PLC meetings were led by an assistant principal or curriculum facilitator and focused on cooperative learning strategies (follow-up interview, 3/2/2011). Occasionally, PLC meetings were canceled to give priority to other school-wide happenings, such as blood drives and festivals, or Jessica was unable to attend. Due to this, I observed only one PLC meeting for Jessica. During the PLC I observed, a representative from the district's student assistance programs presented on service learning, which, along with other aspects of character development, was an important initiative within the district (observation, 5/11/2011). Jessica felt this particular PLC meeting was not helpful because she did not gain ideas for implementing service learning in her classroom (interview, 5/12/2011). During a typical PLC meeting, Jessica gained activities and ideas, particularly about cooperative learning, that she could use in her science teaching (interview, 5/12/2011).

Summary/interpretation of Jessica's support from her colleagues and PLC. The support Jessica received from her science colleagues afforded beginning science teacher identities-in-practice as someone who planned with her subject-like colleagues. In her interactions with colleagues, afforded identities-in-practice centered on being able to ask for and receive help and materials. The primary person from whom Jessica asked for and received help related to her science teaching was her chemistry colleague. Interactions with her chemistry colleague during collaborative planning meetings, however, positioned Jessica as a follower rather than a leader with her more experienced chemistry colleague taking on the role of lead chemistry teacher during the collaborative planning meetings. As someone who received everything from others, particularly her chemistry colleague (interview, 3/2/2011), collaborative planning meetings were not essentially collaborative. Rather, the meetings were unidirectional with the other chemistry teacher at the helm.

In her interactions with colleagues, Jessica took up beginning science teacher identities-in-practice as someone who could and did go to colleagues with questions and for help. Though Jessica's chemistry colleague shared all of his teaching materials with her, she did not use each and every thing in her own teaching. Within this context, Jessica took up beginning science teacher identities-in-practice as someone who intentionally, rather than indiscriminately, used materials from her chemistry colleague. Jessica recognized that certain materials and activities her colleague used did not suit her teaching style or strengths. For example, during the first semester, Jessica primarily used her colleague's materials. In doing so, she realized that she did not like teaching through models, so during second semester she and her colleague taught some topics in different ways. Even though Jessica and her colleague taught some topics using different instructional strategies and activities, they did always teach the same topics at the same times. Jessica, then, enacted beginning science teacher identities-in-practice as someone who adhered to the sequencing and pacing determined during collaborative planning meetings. As previously mentioned, Jessica found herself relying less on her chemistry colleague's support as the school year progressed. In this way, Jessica enacted beginning science teacher identities-in-practice as someone who needed and received less help from others as she gained experience teaching chemistry. Jessica identified the support she received from her chemistry colleague during collaborative planning meetings as her most important support. She appreciated the opportunity to talk about teaching chemistry everyday with her chemistry colleague whose classroom was directly across the hall from Jessica's. Coupled with the general support Jessica received from her mentor, Jessica could not identify a need during her first year of teaching that was not met by one of these two vital supports.

Unlike Jessica's interactions with colleagues during collaborative planning, her PLC meetings were general rather than science-specific. School-wide PLC meetings coupled with the fact that Jessica's mentor was not a science teacher reemphasized beginning teacher identities-in-practice as someone who needed and benefitted from general, as opposed to science-focused, instructional support. Led by administrators and the school's curriculum facilitator, Jessica's general PLC meetings were top-down, affording beginning—and experienced because everyone in the school attended PLC during their planning periods—teacher identities-in-practice that assumed teachers did not know the support or professional development they needed or wanted during these administration-planned sessions. Though planned by administration and top-down in nature to allow teachers to become familiar with school and district initiatives, the occasional canceling of PLC meetings implied and afforded beginning and experienced teacher identities-in-practice as someone who was not vital to support. In this context, Jessica enacted "good teacher" identities-in-practice. That is, she attended and participated in the twice-monthly PLC meetings as she was expected. In our interviews, she discussed appreciating the professional development on cooperative learning; however, she did not mention this professional development during any of our post-observation interviews about her classroom science teaching. As with strategies for cooperative learning, when Jessica perceived that the PLC topics were useful in her classroom, she took up beginning teacher identities-in-practice that valued the general, generic support provided during PLC meetings. However, when Jessica did not perceive a connection to her classroom instruction, such as during the PLC focused on service learning (observation, 5/11/2011), she was less likely to take up beginning teacher identities-in-practice that valued the general support offered during PLC meetings.

With a mentor outside of her licensure area, and general beginning teacher and PLC meetings, Jessica's science colleagues and collaborative planning meetings were her only science-specific supports.[18] With limited science-specific support, Jessica's induction countered the premises of Luft and Patterson's (2002) science-specific ASIST program, and did not lead to inquiry- and standards-based science teaching promoted and fostered in science-specific induction programs (Luft et al., 2003). Luft and Patterson's (2002) and Luft et al.'s (2007) premises for science-specific induction included long-term induction programs that were essential for the socialization of beginning science teachers; the need for support programs that addressed beliefs and practices specific to science and science teaching; and collaboration between the university, school district, and experienced teachers.

[18] Jessica did not attend the district's content-focused seminars because they conflicted with her tutoring schedule.

Unlike the other beginning secondary science teachers in this study, Jessica's PLC meetings were not content specific. Instead, Jessica met twice a month with fellow teachers who shared the same planning period. With a focus on cooperative learning, Jessica's PLC was committed to ensuring student learning and developing a collaborative culture among school faculty, two "big ideas" for professional learning communities (DuFour, 2004). However, without content-focused conversations, teachers had limited opportunity during PLC to explore three crucial questions: "What do we want each student to learn? How will we know when each student has learned it? How will we know when each student experiences difficulty in learning?" (DuFour, 2004, p. 8).

Administration. While Jessica acknowledged not "really see[ing] the administrators that often," she appreciated the professional development they provided, saying "I've taken away things that I've actually used from their sessions" (initial interview, 11/4/2010). As she explained,

> this year they're doing a big to-do with cooperative learning, so we work with that a lot and we learn classroom activities that we can do. And on our half day [professional developments] we have learned about, they're very data-driven, so we have learned about Achievement Series and Test Pro and better ways to gather data from our assessments and compare with other teachers. (initial interview, 11/4/2010)

In addition to planning beneficial professional development, Jessica's administrators were available to the school faculty, especially the beginning teachers, if needed: "The administrators, they're great too . . . [W]e can go and ask them questions and come to them with issues. You know, they always, if we ask them to do something, it gets done" (interview, 3/16/2011).

Summary/interpretation of Jessica's administrative support. Based on Jessica's interactions with administration, particularly during the PLC meetings they led, her administrative support afforded beginning teacher identities-in-practice as someone who attended and learned from the professional development the administration provided. Additionally, a focus on Achievement Series and Test Pro implied beginning teacher identities-in-practice focused on using data to make informed instructional decisions. Beyond the context of PLC meetings and professional development, Jessica's administrative support afforded beginning teacher identities-in-practice as someone who could and would go to the administration with questions or for help if needed. Although Jessica did not discuss a time during our interviews when she approached the administration with questions or concerns, she did take up promoted beginning teacher identities-in-practice as someone who attended and learned from the professional development that the administration provided. She typically found the professional development provided by administration to be helpful because she gained ideas and activities she could use in her classroom; this was particularly true for PLC meetings and professional development focused on cooperative learning.

Though the administration was not frequently visible in Jessica's classroom, she felt supported and comfortable going to them with questions or issues. To support beginning teachers in the school, the administration was positive and actively engaged with teachers; maintained an orderly schools; and, when necessary, supported classroom management (Johnson & The Project on the Next Generation of Teachers, 2004). Likewise, in supporting the induction coordinator (interview with Jessica's induction coordinator, 1/5/2011) and purposefully pairing beginning teachers with mentors, Jessica's administration supported the goals of the district's and school's induction program as well as those who assisted and mentored beginning teachers (Bartell, 2005).

Noyce support. In addition to the supports previously discussed, Jessica also received support from her university's Robert Noyce Teacher Scholarship Program. In Chapter III, I described the Noyce supports Jessica was provided; therefore, the following discussion focuses on the ways in which Jessica accessed and utilized those supports.

Jessica did not draw heavily on the Noyce supports available to her. In an informal conversation at the start of the school year, Jessica mentioned that she wanted help with time management and earth/environmental resources (personal communication, 9/27/2010). Other Noyce teachers—none of whom were earth science majors, but all of whom taught earth/environmental science during their first year of teaching—wanted help with earth/environmental science resources as well. In response to their needs, I, as project coordinator at the time, arranged a resource exchange with an experienced earth/environmental science teacher at a local coffee shop (11/10/2010). Jessica did not attend.

Jessica drew on the Noyce Program primarily for non-instructional support. Aside from checking in with her about her students and instruction, the primary way I supported Jessica through the Noyce Program was to help her organize her classroom and post student work at the end of the first grading quarter. I assisted her in posting student work, cutting out new word wall words, and taking down previous word walls (10/28/2010).

She did not ask for instructional assistance throughout the school year nor did she discuss her classroom instruction in depth outside of our scheduled interviews.

Jessica's university's Noyce Program afforded beginning science teacher identities-in-practice as someone with unique and time-sensitive needs. As project coordinator at the time, I communicated with each of the university's three Noyce teachers to ask and learn more about their particular needs; then, I responded to each of those needs in a timely manner to give Noyce teachers "just in time" science-focused support that they might have needed. By focusing on science, rather than general, instructional support, the Noyce Program also afforded beginning science teacher identities-in-practice as someone who needed supports that supported and enabled science instruction. Within the context of the Noyce supports available to her, Jessica took up beginning science teacher identities-in-practice as someone who benefitted from non-instruction, non-science-specific support and help. When I specifically asked Jessica how I could help her, Jessica asked me to display her students' work on the walls and change her word wall; we did not talk about her science instruction. Even when science-focused support was offered in response to a need she and other Noyce teachers communicated to me, Jessica did not attend the earth/environmental science resource swap (11/10/2010). In this way similar to the identities-in-practice Jessica took up during mentor/mentee meetings, beginning teacher meetings, and PLC, Jessica enacted beginning teacher identities-in-practice that were not necessarily science-focused; she took up science teacher identities-in-practice as someone who did not need science-specific supports during her first year of teaching.

Summary/interpretation of Jessica's induction experiences. The beginning science teacher identities-in-practice afforded by Jessica's induction experiences almost exclusively centered on policies and procedures. See Table 11 for a summary of the identities-in-practice afforded by each of Jessica's induction supports, as well as the identities-in-practice she enacted during and meanings she made of each support. With the exception of her collaborative planning meetings, Jessica's induction supports were also very general (e.g., her mentor was not a science teacher, her PLC meetings were school wide rather than content specific). Counter to the literature (Bartell, 2005; Britton et al., 2000; Luft et al., 2003, 2007; Luft & Patterson, 2002; Roehrig & Luft, 2006), the general nature of her induction supports was unproblematic for Jessica: She felt that since she knew the chemistry content, she did not necessarily need science-focused help or support. That is, since she was well versed in her content area, she felt she would need support primarily with classroom management. Once she mastered classroom management, she would have figured out how to successfully teach high school chemistry.

Focused on policies and procedures and affording Jessica and other beginning teachers little agency to voice the kinds of supports they felt they needed, Jessica's induction supports were top-down. The topics of her mentor/mentee and beginning teacher meetings were determined by her mentor and induction coordinator respectively. Adding layers to the top-down approach of induction, the topics Jessica's mentor discussed with her were not necessarily determined by the mentor based on her knowledge of Jessica's strengths, weaknesses, and needs; rather, they frequently discussed topics that the induction coordinator set forth in weekly mentor meetings. Likewise, PLC topics were chosen and meetings led by administrators. Even in the context of her collaborative planning meetings, rather than taking an equal role for sharing ideas, resources, and chemistry teaching materials, Jessica followed along with the other chemistry teacher.

Table 11. Summary of Jessica's Induction Experiences

Induction Supports	Beginning Science Teacher Identities-in-Practice		Meanings Made
	Afforded	Taken Up	
District-level supports	Orientation: As someone focused on policies and procedures Induction and success coach: As someone focused on professional files	As someone who knew and followed policies and procedures; who completed professional files	Induction and success coach's support appreciated when compiling professional files
Mentor	As someone aware of policies and procedures; who needed "checking up on;" who benefited from general support	As someone knowledgeable of policies and procedures; who primarily needed help with classroom management	One of most important supports; provided general support that paired well with support from chemistry colleague
Beginning Teacher Meetings	As someone free to ask questions of and receive feedback from peers; who had valuable ideas and experiences to share with peers; who needed and could give support	As someone who asked and answered peers' questions; who had ideas and experiences to share; who was well informed of school schedules, policies, and procedures; who could get similar support elsewhere	Valued procedural support; received support similar to what was gained from mentor, so could do without beginning teacher meetings

Table 11 (cont.)

Induction Supports	Beginning Science Teacher Identities-in-Practice: Afforded	Beginning Science Teacher Identities-in-Practice: Taken Up	Meanings Made
Colleagues and PLC	Collaborative Planning: As someone who planned with subject-like colleagues; who asked for and received help; who followed more experienced teacher's lead PLC: As someone who benefitted from general, top-down support; who needed to be aware of school and district initiatives	Collaborative Planning: As someone who could and did go to colleagues with questions; who always taught the same topics her colleague did; who used teacher materials from colleague; who needed less help as she gained experience PLC: As someone who attended meetings as expected; who appreciated administrations support via PLC meetings	Collaborative Planning: Most important support because could talk about chemistry everyday with colleague PLC: Gained ideas and activities related to cooperative learning that were useful in her classroom
Administrators	As someone who learned from professional development administrators provided; who implemented professional development; who could go to administrators with questions or for help	As someone who learns from professional development administrators provided	Administrators not visible, but supportive
Noyce	As someone with unique and time-sensitive needs; as someone needing supports focused on science instruction	As someone who benefitted from non-instructional supports; who did not need science-specific supports	Rarely accessed Noyce supports

In these contexts, Jessica accepted, enacted, and did not push back against the afforded beginning science teacher identities-in-practice. By maintaining the focus on policies and procedures, Jessica's enacted beginning science teacher identities-in-practice did not involve critical reflection on her teaching practices. Because of the instruction support they provided, Jessica named her mentor and chemistry colleague as her most important induction supports, but these supports did little to encourage her to teach in more ambitious, inquiry-based ways. In fact, the dependence on lectures, worksheets, and verification labs I observed in Jessica's science teaching countered the vision for science teaching she set forth in our initial interview. Initially, she discussed that "science classes need to be inquiry based and, umm, my goal is to keep students engaged at all times" (initial interview, 11/4/2011). As I discuss below with Research Question 2, Jessica did not maintain the inquiry focus in her science teaching that she discussed toward the beginning of the school year, but her induction supports did little to encourage and foster such teaching. Given this, the beginning science teacher identities-in-practice that Jessica enacted were, like Ingrid's, rather narrow and conforming.

Identities-in-Practice Enacted by Jessica while Teaching (Research Question 2)

Jessica's induction supports were more general and less science-focused than Sophia's, Ingrid's, and Whitney's supports. While others participated in subject-like PLCs and mentoring, Jessica's PLC was school-wide with all the teachers who shared her planning period, and her mentor was an art teacher. When enacting beginning science teacher identities-in-practice as someone who knew and followed policies and procedures, was knowledgeable of her content area, and needed support primarily with classroom management as opposed to science instruction, elements of beginning teacher identities-in-practice centered on *science* teaching were inherently missing. In analyzing Jessica's induction experiences and classroom science teaching, I was struck by the fact that she only had one science-focused induction support—collaborative planning with her chemistry colleague. Based on this realization and research on beginning science teachers' science teaching beliefs and practices (Luft et al., 2003, 2007; Luft & Patterson, 2002; Roehrig & Luft, 2006), it was no surprise that Jessica's classroom science teaching tended away from inquiry more so than incorporated it.

Jessica's honors chemistry classes typically started with students answering a set of bell ringer questions, which Jessica reviewed five or ten minutes into class. While students worked on the bell ringer, Jessica would circulate among students, stamping started bell ringer questions and completed homework. At the end of each week, students turned in the week's bell ringers, receiving credit for the ones that were stamped; at the end of each month, students turned in their homework credit cards, a calendar that Jessica stamped for each day students came to class with their completed homework. Her classes were very organized and typically followed a common format: bell ringer, whole class discussion and notes, then independent practice, counter to inquiry-based teaching practice that could be supported through science-focused induction supports. Based on the information Jessica wrote on the board each day, students knew what to expect each and every class. On the right side of her white board, Jessica always included the lesson's essential question, curriculum goals and objectives for the lesson, and a daily agenda. Across my observations, Jessica was confident in her content knowledge, and comfortable answering students' questions and using tablet technology. Description of a typical honors chemistry class follows.

At the start of one of my observations, Jessica's students completed a warm-up, which was displayed on the board when they arrived to class. While students completed the bell ringer, Jessica passed back to students the previous day's bell ringer. They were expected to turn in the week's bell ringers by the end of the period. Jessica then reviewed the answers to the bell ringer questions that focused on conductors and insulators. Students identified whether diagrams depicted conductors or insulators and defined the terms conductor and insulator. Next, Jessica went over notes on naming chemical compounds. She did not distribute note sheets to students, so they were responsible for copying the notes from the board. During the notes, Jessica responded to students' questions and provided additional examples by using her tablet when necessary. Following the notes, Jessica passed out a homework packet to students. Students had the remaining 45 minutes of class to work on the homework packet. While students worked on their homework packets, Jessica circulated around the classroom to answer students' questions, talk informally with students, and redirect students' off-task behaviors. To start, most of the students, especially the girls in the class, worked on the packet. As time when on, however, fewer and fewer students were on task; Jessica seems to put forth less effort to redirect their behaviors (observation, 3/18/2011).

Of the eight classes I observed, three included either a demonstration (observation, 3/4/2011; observation, 5/10/2011) or investigation (observation, 3/10/2011). For the observed demonstrations—diffusion of liquids, bottle rocket, elephant toothpaste, and soda geyser—Jessica seemed more interested in hooking students with the “wow factor;” limited discussion of the science followed each demonstration. The investigation I observed was a heating experiment with paraffin wax. As during all the lessons I observed, Jessica started class by having students complete a bell ringer, which was displayed on the board when students came into the classroom. For the bell ringer, students picked up graph paper from the projector and answered three questions on temperature change: (a) A sample of liquid water cools from room temperature (25°C) to -10°C. If the mass of the water is 10g, what is the quantity of heat released?, (b) A 100g sample of liquid water at room temperature (25°C) is heated until half of it has boiled away. How much energy did the water absorb?, and (c) While you were ‘sweating’ your chemistry test, water vapor evaporates from your body, adsorbing 125kJ of energy. (Assume no temperature change.) What mass of water evaporates? During this time, Jessica circulated among students to stamp homework and started warm-ups. Afterward, Jessica used her tablet to review the bell ringer with students. Several students commented that they did not understand the heat calculations. Jessica took care in explaining the bell ringer problems as she went over them. Next, she projected the heating curve of water onto the whiteboard; she talked about the curve with students and labeled important information, such as phases and phase changes. Then, Jessica distributed the heating of paraffin wax lab sheets and reviewed the procedure with students. The remainder of class students completed the lab, graphed their data, and answered the post-lab questions. During this time, Jessica circulated to monitor behavior, check for progress, and answer students’ questions. With less called for in the lab procedure—student groups stirred their wax, timed intervals between readings, and read and recorded the temperature—than there were students in each lab group, several students seemed unengaged in the experiment. Once groups had completed the paraffin wax cooling experiment, they worked with their lab groups to graph the data and answer the post-lab questions. If students did not finish their graphs in class, the graph, along with four heat calculation problems, were assigned as homework (observation, 3/10/2011). Jessica's vision for this lesson was for students to practice data collection and graphing. She, however, did not speak to the reality of the heating investigation compared to her vision because students did not complete the entire lab during the class period. Jessica planned to discuss the lab during class the following day (interview, 3/10/2011).

As reported by Jessica, her collaborative planning meetings—her only science-focused support—were most impactful on her teaching. Though I was unable to observe these collaborative planning meetings,[19] Jessica discussed mapping units as well as deciding on and planning major activities and investigations with her chemistry colleague. During first semester, Jessica drew heavily on this support; second semester, she relied on it less.

Jessica's thin reflective practices accepted during her mentor/mentee meetings were mirrored in her reflections following the observed lessons. She thought the reality of nearly all her lessons matched with her visions for the lessons and did not discuss making changes to these lessons when she taught them in the future. Frequently, Jessica gauged

[19] Jessica and her chemistry colleague were supposed to meet afternoons of the second and forth Monday of each month; however, due to both their schedules and tutoring, these meetings were frequently rescheduled or done via email.

the success of a lesson based on the questions students asked, failing to recognize that students asked her the same questions repeatedly (observation, 3/2/2011; observation, 5/5/2011; observation, 5/10/2011). When Jessica realized she was answering the same students questions again and again, she accepted that she must repeat information but did not discuss how students' questions impacted her instructional decisions: "[T]he questions they ask me are things they should know. But, I mean, I've gotten used to them asking me questions that I've told them a thousand times anyway, so. I've gotten used to it" (interview, 5/9/2011). She only mentioned revising her lessons on two occasions (interview, 3/10/2011; interview 5/9/2011). Both of these lessons (observation, 3/4/2011 on energy bar charts; observation 5/5/2011 on balancing equations) involved introducing new concepts. Jessica mentioned introducing the new concepts in a different matter, but did not go into detail regarding an alternative means. For example, in thinking of the lesson on balancing questions, Jessica said she wanted "to introduce the concept differently. Like, I want to think of a way to show them visually, like maybe if it's some sort of, something I can project onto the screen that show the actual, like compounds maybe" (interview, 5/9/2011). Though she did not identify a specific compound or example that she should "project onto the screen," this idea for revising her lesson revealed a deeper level of reflection than was typical. In the other instance that she mentioned revising lessons for the future, she knew she should rethink the way she introduced energy bar charts because students "seemed confused"; however, she did not offer specific ideas. In this reflection, Jessica projected beginning science teacher identities-in-practice as someone who knew how to teach by right of knowing the content; however, her response to students' confusion (and understanding too for that matter) was to repeat the chemistry content.

Though Jessica reported, and I observed her, participating in various induction supports—mentor/mentee meetings, PLC, beginning teacher meetings, and collaborative planning—there was a disconnect between these supports and Jessica's classroom teaching. In eight observations, I did not discern a direct influence of these supports on Jessica's teaching. Therefore, while knowing Jessica participated in her induction experiences, I cannot say that such engagement served as sources of her budding professional identity.

Whitney

Portrait of Whitney

Whitney graduated from a traditional undergraduate teacher preparation program at a four-year public university (student population 21,306) in the southeastern United States licensed to teach high school biology. During the last year of her teacher preparation program, Whitney was awarded a summer internship and academic scholarship through her university's Robert Noyce Teacher Scholarship Program. As part of her summer internship, Whitney worked with a science education faculty member at a week-long residential herpetology camp for high school students. (For a detailed discussion of the camp's field experiences, see Tomasek, Matthews, & Hall, 2005.) She

> spent the week with the kids and then continued their research [once camp ended]. So, at the beginning they asked, they developed their questions and then the questions that we could still research for them to make sure that their data was complete, umm, I went out probably once or twice a week I'd say and collected more data [for students' research projects]. (initial interview, 11/8/2010)

She continued her work with students and faculty from the herpetology camp throughout her senior year of college, attending some of their monthly meetings and events. Like Jessica, Whitney participated in cohort activities for Noyce scholars during the academic year, including attending the state's science teacher conference (11/19/2009, 11/20/2009) and the regional Noyce conference (3/26/2010, 3/27/2010); visiting and becoming familiar with community resources that supported science teaching such as the local natural science center (11/5/2009) and biological supply company (11/6/2009); and observing excellent science teaching in a variety of contexts such as high-needs schools (11/13/2009) and middle/early colleges (2/17/2010). Upon graduating, she found a job primarily teaching earth/environmental science, so her school petitioned the state to award Whitney comprehensive science licensure.

Whitney was driven to become a high school science teacher because of her own weak high school science experiences:

> [W]hen I was in high school, I never had a very strong science experience and had teachers that had come from outside of the field [of education] and then come into teaching and so, umm, when I went into college I knew that I wanted to teach some aspect due to my dad being a teacher and just loving the profession and then was kind of drawn to science because of the courses I was able to take and the experience I had in wanting to give students another opinion of science other than pure hatred toward the subject. (initial interview 11/8/2010)

Her love for teaching was evident in the experiences she sought. In addition to her experiences with the Noyce Program, Whitney worked in several teaching capacities during her college career. She worked with high school students in academics and athletics alike, tutoring biology students at a local high school and helping her high school volleyball coach with the team. Additionally, she tutored biology in the university's Learning Assistance Program.

Based on these experiences, her teacher preparation coursework, and her internships and student teaching, Whitney felt well prepared to be a secondary science teacher. When talking about the vision she had for herself as a science teacher, she emphasized enabling her students to see the relevance and applicability of the science content she taught: "I think my biggest vision is to allow students to be able to realize the connections between science and everyday life" (initial interview, 11/8/2010). An emphasis on helping her students connect the science they learned in school to everyday life was also evident in Whitney's meanings of "successful science teacher." She explained,

> you have to be able to know when your students are understanding and when your students are applying the content that you're teaching. I think that to understand the content means they can regurgitate it. I think to be able to apply it means they can connect it to things that you haven't connected it to, and I think that's the big gap I'm trying to bridge. (initial interview, 11/8/2010)

During November of her first semester of teaching, Whitney accepted a unique challenge. A science colleague, who taught biology, was placed on bed rest during her pregnancy and the school's administrative team was looking for someone to take over the biology teacher's classes. Always a team player and with a background in biology, Whitney agreed to take over her colleague's three biology classes. She continued to teach her own earth/environmental science class during her "free" period—her own idea; not forced upon her by the administration. Of this experience, Whitney recounted, "It taught me that I, you know, that I can handle almost anything [laughs] . . . I don't regret doing it. I feel like I've grown as a teacher and, umm, I feel like the kids are much better off" (follow-up interview, 1/11/2011). In meeting this opportunity with success—her students' standardized test scores on the state's end-of-course (EOC) biology test were on par with the other biology teachers—Whitney's schedule for second semester was changed to include two sections of biology and one of earth/environmental science.

Though Whitney abruptly took on the pressures of teaching a state-tested subject, her meanings of successful science teacher—focused on connections and applicability—endured. Toward the end of the first semester, Whitney explained what it meant to her to be a successful science teacher:

> *Whitney*: I feel like to be a successful science teacher, umm, it just means that I'm able to show the students how our content can be applied and is relevant to real life. I feel like if you can apply what we do outside of the classroom, then I've been successful.
>
> *Angela*: OK. My next question [laughs], my next question was gonna be if you thought that had changed since you'd taken on that EOC course, but if I remember correctly, that's almost exactly what you told me when we talked toward the beginning of the year. So.
>
> *Whitney*: [laughs] Right. The only change I think would be that another way that I think I would measure 'successful' is whether or not my kids can perform on the EOC . . . So, that would be the only way it's changed. But I still feel like if they can apply it to real life, then they can pass the EOC. So. (follow-up interview, 1/11/2011)

After teaching two sections of biology during the second semester, Whitney's notions of success persisted: "I think it means that you are able to make, relate concepts to kid-, to students so that they understand them and want to apply them . . . [B]eing an effective science teacher, umm encourages kids to want to know more" (final interview, 5/16/2011). When asked how students' EOC scores factored into her meaning of successful science teaching, Whitney maintained,

> I don't really see them hand-in-hand . . . I think that also too being successful doesn't necessarily mean that your kids can ace a test. It means that they can use the information. Now, does that mean I expect scores to be super low? No, but I don't expect that in order to be successful a lot of 4s [the highest level of proficiency on the state EOC] would have to show up . . . You know, I feel like if a kid can talk about a concept and can apply it and can look at you and say, well here it is in action, that's success. (final interview, 5/16/2011)

Throughout the school year, Whitney recognized the importance of a supportive and safe classroom environment in meeting her definitions of success.

At the end of her first year, Whitney reflected fondly on her experiences as a new teacher, recognizing that while she still had work to do to become the science teacher she wanted to be, she was on the right path:

> I've really gotten my feet wet in a lot of different areas. So, I feel like that's gonna help me grow over time too. Umm, I don't know. I feel like as a first year teacher I've been really successful. You know, and that, you know, I definitely have more to do and more to accomplish, but I'm on the right track. (final interview, 5/16/2011)

As Whitney reflected on her first year of teaching, her emphasis on interesting students in science and taking a personal interest in their success came to the forefront. When asked about her biggest success during her first year of teaching, Whitney hoped "it'll be my EOC scores. [Laughs.] Just because, you know, that's what everyone looks at" (final interview, 5/16/2011). But, she felt successful in taking an interest in and having a positive impact on her students as well: “I’ve really been able to work with some kids who would normally shut down on themselves and I’ve been able to kind of help some kids realize that maybe science is a really good field for them” (final interview, 5/16/2011). In working with mostly underclassmen, Whitney maintained that the most important thing she learned over the course of the school year was patience, saying “I knew I needed it . . . but it is definitely the biggest thing I have learned” (final interview, 5/16/2011).

At the conclusion of her first year as a high school science teacher, Whitney planned to return to her school again the following year. In fact, she was most looking forward to her new classroom that was under construction: “Being in an actual science lab. And being able to feel like I can actually settle a little bit . . . kind of getting my set up and, you know, a classroom that I’m comfortable in and can really use” (final interview, 5/16/2011).

Of the four beginning secondary science teachers in my study, Whitney was the only one to be nominated for the school district’s Rookie Teacher of the Year award. I further discuss the support she received in compiling her nomination packet for this award below.

Summary/interpretation of Whitney’s meanings of successful science teaching. Overall, Whitney’s experiences during her first year of teaching afforded beginning science teacher identities-in-practice as someone who was a team player and who could be counted on in high-pressure situations. When Whitney’s biology colleague went on bed rest, the school’s administration did not hesitate to have Whitney take over her colleague's classes. Likewise, Whitney did not hesitate to take on this new and challenging role. In having Whitney teach her colleague's three biology classes and allowing her to teach her own earth/environmental science class during her planning period, however, Whitney's administration and mentor did not afforded beginning science teacher identities-in-practice as someone whose time should be protected; Whitney taught four blocks a day much of first semester.

When teaching her colleague's biology classes specifically, and over the course of her first year of teaching in general, Whitney enacted beginning science teacher identities-in-practice as someone who learned from all of her experiences, regardless of how challenging they seemed from the outset. She recognized and took up beginning science teacher identities-in-practice that focused on having room to grow and learn as a science teacher no matter how successful she perceived an activity, lesson, or experience to be. In her willingness to teach her biology colleague's classes, Whitney took up the promoted science teacher identities-in-practice as a team player. Additionally in this situation, she enacted beginning science teacher identities-in-practice that recognized that she had valuable expertise in teaching biology that she could share with her colleagues and her colleague's students—in the case of taking over her colleague's biology classes while she was on bed rest.

When it came to teaching her earth/environmental science and biology classes, Whitney enacted beginning science teacher identities-in-practice focused on getting students to recognize and understand the connections and applicability of the science content to everyday life. With these identities-in-practice, students' EOC scores became secondary. That is, Whitney believed that if her students could apply the content they were learning, then they would understand the content well enough to pass the state's EOC exam. Though Whitney was unexpectedly thrust into the world of high-stakes testing and accountability, her meaning of successful science teaching remained unchanged over the course of the school year. Unlike Ingrid, an emphasis on students' EOC scores did not overtake Whitney's original meaning of successful science teaching; rather, Whitney accommodated students' EOC scores into her definition all the while retaining an emphasis on showing students the relevance and applicability of the science content she taught. Differences in the infiltration of a culture of testing in Ingrid's and Whitney's meanings of successful science teaching could be attributed to the differential status of the school—Ingrid's as a priority school,[20] and Whitney's as a school of progress.[21] For Ingrid and the faculty, students, and administrators at her school, the stakes were higher; thereby test results became the barometer against which effective teaching was measured. Such was not the case at Whitney's school, illuminating the role of context plays in beginning teachers' perceptions of teaching (Bartell, 2005; Johnson & The Project on the Next Generation of Teachers, 2004).

Whitney's Induction Experiences (Research Question 1)

Whitney was drawn to her teaching position, in part, because of the supports she knew she would receive as a beginning teacher in the district. As she explained,

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[20] According to the state's Department of Public Instruction, *priority schools* are those with less than 60% of students achieving at or above Level 3 on state EOC exams, irrespective of meeting expected growth standards (http://www.ncpublicschools.org/docs/accountability/reporting/abc/2010-11/execsumm.pdf).

[21] The state's Department of Public Instruction defines *schools of progress* as those that achieved at least expected growth and had at least 60% of their students achieve at or above Level 3 on state EOC exams (http://www.ncpublicschools.org/docs/accountability/reporting/abc/2010-11/execsumm.pdf).

> to be completely honest, and the reason why I chose [this school district] is because I've got such a strong support system with, umm, [the science curriculum support specialists], umm, offering the curriculum [content-focused seminars]. So, I've got that support. I've got support from [orientation and beginning teacher meetings]. I've got [an induction and support] coach. I've got my Noyce Scholarship support. (initial interview, 11/8/2010)

During our initial interview, Whitney explained what she hoped to gain from her induction supports during her first year of teaching: a better understanding of the resources and opportunities available to her because she wanted "to adapt and be able to better provide for my students as well" (initial interview, 11/8/2010).

Even at the start of the school year, Whitney enacted robust beginning science teacher identities-in-practice that positioned herself as a new teacher and the subject matter she taught in more fluid ways than my other study participants. For example, three months into the school year, Whitney described and enacted beginning science teacher identities-in-practice as someone who was knowledgeable of the induction supports available to her, aware of the fluidity of the subject matter she taught, and who wanted opportunities and resources to "grow as a better teacher" (initial interview, 11/8/2010).

District orientation, and induction and success coach. Like Ingrid and Jessica, Whitney attended district orientation but did not reference it as a support in any of our interviews. She did, however, discuss her induction and success coach, who she initially met during district orientation. Whitney described her induction and success coach as a confidence booster particularly because "she was a good person to have during the Rookie Teacher of the Year stuff 'cause she read [the nomination packet]" (final interview, 5/16/2011). Though Whitney named her induction and success coach during earlier interviews (initial interview, 11/8/2010; follow-up interview, 1/11/2011), she did not describe the types of support she received from the coach until the final interview when her induction and success coach was vital in helping Whitney review her nomination materials for Rookie Teacher of the Year (final interview, 5/16/2011).

Summary/interpretation of Whitney's district-level supports. As for other beginning secondary science teachers in this study, Whitney's district-level supports afforded beginning teacher identities-in-practice centered on knowing and following district policies and procedures. Likewise, such policy- and procedure-oriented identities-in-practice were also afforded by Whitney's induction and success coach. Since Whitney and Jessica had the same induction and success coach, it can be inferred that Whitney also received reminders to and help with compiling her professional file. Whitney's induction and success coach also reviewed Whitney's Rookie Teacher of the Year paperwork with her prior to submission. Within this context, Whitney took up promoted identities-in-practice as someone who knew and followed policies and procedures. Additionally, she enacted beginning teacher identities-in-practice that implied she was knowledgeable of the district-level supports available to her—orientation, secondary science coordinator, her induction and success coach, and content-focused seminars—and knew who to contact for particular kinds of support. For example, Whitney accessed her induction and success coach's experiences and expertise for help in compiling and proofing the documents required for her Rookie Teacher of the Year nomination.

Similar to Ingrid and Jessica, Whitney did discuss district orientation at a specific support she received during her first year of teaching. She recognized, however, that her induction and success coach provided "good support" that served primarily to boost her confidence. As the school year progressed, Whitney signified the support she received from her induction and success coach when that support became particularly meaningful to her: as Whitney completed her paperwork for the district's Rookie Teacher of the Year award.[22]

School-based supports. Like other beginning secondary science teachers in this study, Whitney discussed her school-based supports, particularly collaborations with colleagues, as especially supportive.

Mentor. Unlike Sophia and Jessica, Whitney did not meet regularly with her mentor nor did they sustain mentor/mentee meetings throughout the school year. In fact, Whitney formally met with her mentor only once, a meeting she audio recorded for this study. As she explained, "me and my mentor have had more conversations than meetings per se" (follow-up interview, 1/11/2011). She shed light on her relationship with her mentor saying,

> I think because we are at different ends of the spectrum within our career and because I am very personally driven and we're in different subjects and different buildings, there are a lot of limitations that we've reached to where we just really haven't been able to meet and kind of facilitate as much as we would like. (final interview, 5/16/2011)

Despite difficulties with planning and facilitating mentor/mentee meetings, at the beginning of the school year, Whitney found her mentor to be a "go-to in a state of panic" for support related to ordering class supplies and completing components of her teacher

[22] Whitney was honored as a nominee for the district's Rookie Teacher of the Year award, but ultimately was not a finalist for the award.

evaluation, such as her personalized development plan and self-evaluation (initial interview, 11/8/2010). As Whitney explained, her mentor was a great help with respect to the teacher evaluation paperwork because “we actually did both of those together so that I can kind of be on the right track and know what goals to set and what goals might be too big, you know, to tackle at this point” (initial interview, 11/8/2010). Additionally, Whitney’s mentor was someone she could “kind of bounce ideas off of. You know, do you think this would work? How would I make this work? This is my idea” (initial interview, 11/8/2010). Although Whitney’s mentor supported her in various ways at the beginning of the school year, Whitney held “very low expectations” for her mentor. Since Whitney taught earth/environmental science and biology while her mentor taught chemistry, Whitney recognized that “the things I would be wanting more, content materials, things like that, I’m getting from another colleague. So, I have very low expectations for my mentor because I have so many other branches” of support (initial interview, 11/8/2010).

The one formal meeting Whitney had with her mentor, however, was heavily focused on improving Whitney’s science instruction, with many of the topics of conversation initiated by Whitney herself (mentor/mentee meeting, 12/14/2010). It was evident that Whitney came to the mentor/mentee meeting well prepared; she seemed to have a list of questions to ask her mentor. Whitney’s mentor listened closely and offered feedback and suggestions when appropriate. Topics discussed at the meeting included Whitney’s recent observation and teaching evaluation; how she thought her students’ EOC scores would be based on a recent common assessment and how poorly written she thought the district's common assessments were; ideas for planning biology for the remainder of the semester and her ideas for biology EOC review; ideas for planning earth/environmental science for the remainder of the semester; working relations with the substitute who taught her earth/environmental science class while she taught her colleagues biology classes; ideas for a final project or essay test in earth/environmental science; and applying for Rookie Teacher of the Year (contact summary of mentor/mentee meeting, 12/14/2010).

During this mentor/mentee meeting, Whitney's mentor provided the most instructional support when discussing the essay test for earth/environmental science. Such instructional support was evident as her mentor helped Whitney work through the details of planning an essay test for her earth/environmental science classes:

> *Whitney*: I was thinking about giving my honors [earth/environmental science classes] a, uh, an essay test, and you know
>
> *Mentor*: Problem is you've got to grade them.
>
> *Whitney*: Which, you know, I don't mind reading their thoughts about that because I'm gonna give it to them before exams, so . . . And that way they can show me they understand versus just answer a question . . . I think that would be a really good way for honors. I also
>
> *Mentor*: Yeah, that will really help them because they have the, the writing test that they're gonna have to
>
> *Whitney*: That's true.
>
> *Mentor*: Right. And they need as much writing as they can get. It really does help them. (mentor/mentee meeting, 12/14/2010)

Once Whitney and her mentor agreed that an essay test for her earth/environmental classes was a good idea that would help prepare students for the state writing test, Whitney brainstormed ideas for creating a study guide for the essay:

> *Whitney*: So, do you think, so for a study guide what if I gave them like eight sample essays and they were gonna have to choose three of them or, you know, four sample essays and they're gonna have to write about one, and
>
> *Mentor*: Are you talking about prompts or the actual essay itself?
>
> *Whitney*: Umm, either or just topics.
>
> *Mentor*: Topics.
>
> *Whitney*: Just topics. So then my next question is
>
> *Mentor*: And then, but you better define what your essay, what you want in your essay. For example, if you want, umm, like five paragraphs or something like that you better tell them, I want five well-written paragraphs. How many sentences are in well-written paragraphs?
>
> *Whitney*: Five to eight . . . And see the thing with that is that I've had them doing article assignments and so I also might get them ready for AP because . . . They have to break down articles, so I may end up putting an article on their test like . . . Give them three essays and have them analyze an article. What is the article about? Who does it affect? . . . Things like that. (mentor/mentee meeting, 12/14/2010)

While both Whitney and her mentor liked the idea of an essay test for earth/environmental science, Whitney struggled "trying to think of a way that [standard] could get the gist of doing" the essays (mentor/mentee meeting, 12/14/2010). Recognizing that her standard earth/environmental science class would need more guidance and practice, Whitney and her mentor brainstormed ideas for the types of support to provide:

Mentor: More outline type something to help them to write because they just need a lot of practice . . . You probably don't want to be quite so rigorous on spelling and the grammar and all that.

Whitney: Right. But with honors, it's gonna matter.

Mentor: Yeah.

Whitney: And I will also, I think I might even give them a rubric . . . Here's what I'm expecting. Here's what you can do to prepare . . . And I know what I'll do. What if with [standard], I don't, I give them the same thing but I let them use their, their study guide for like the first ten minutes to plan. You know what I mean. So you guys will get ten minutes at the beginning to see the essay, to see what the essay is. Write down anything you need for them and then you'll have to put everything away.

Mentor: Or you could let them have a 5x7 note card where they write . . . You know, write down some few little ideas . . . You collect those note cards

Whitney: And then pass them out at the exam . . . I like that idea. I like that idea.

Mentor: That way maybe they'll buy into it and maybe they'll think about it a little bit more if they think they're gonna have a che-. Don't call it a note card. Call is a cheat card. I'm gonna give you a cheat card . . . But, how bad, how easily, how much you get to cheat depends on how much you put on your note card. [Laughs.]

Whitney: Exactly. (mentor/mentee meeting, 12/14/2010)

Summary/interpretation of Whitney's mentor support. With only one formal mentor/mentee meeting during the school year, Whitney's mentor support afforded beginning science teacher identities-in-practice as someone who did not need regular, continued, and structured support from her mentor. Additionally, since Whitney's mentor was a chemistry rather than biology teacher, her mentor support implied beginning science teacher identities-in-practice as someone who would need to seek support from colleagues beyond just her mentor.

Against the backdrop of infrequent mentor/mentee meetings, Whitney took up beginning science teacher identities-in-practice as someone who was personally driven and could succeed without regular and sustained mentor support. Unlike Sophia's and Ingrid's mentor support that followed a transmission-type model—they had questions or needs, they went to their mentors with these questions or needs, and their mentors answered their questions or met their needs—Whitney enacted beginning science teacher identities-in-practice centered on collegiality and instructional improvement. Though she went to her mentor/mentee meeting with specific questions, these questions were aimed at improving her instruction; in this context, she positioned her mentor as a "sounding board" for ideas rather than a source of information and answers. To the end of improving her science instruction, Whitney also enacted beginning science teacher identities-in-practice as someone who recognized the limits of her mentor support and sought biology-specific support from her biology colleagues.

Though Whitney was comfortable and confident talking with her mentor, and her mentor was positive and supportive throughout the meeting, Whitney tended not to signify her mentor as a particularly important or impactful support. During our follow-up interview toward the end of first semester, Whitney identified her mentor as her second most import support after other science colleagues (follow-up interview, 1/11/2011); however, during our final interview, Whitney did not list her mentor among her five most important supports (final interview, 5/16/2011). Though strategically paired with another science teacher (Bartell, 2005; Johnson & The Project on the Next Generation of Teachers, 2004; North Carolina State Board of Education, 2010), Whitney credited finding other supports more beneficial to the fact that she and her mentor taught different science disciplines (final interview, 5/16/2011). Despite this mismatch, during the mentor/mentee meeting I observed via audio recording, Whitney's mentor mentored beyond providing emotional support to help Whitney make informed instructional decisions (mentor/mentee meeting, 12/14/2010; Wang & Odell, 2002). Whitney was reflective during the mentor/mentee meeting; however, based on limited data, I could not discern whether her reflection was promoted and fostered during mentor/mentee meetings (for discussion on mentors' roles in promoting reflection see Bartell, 2005; Wang & Odell, 2002).

Beginning teacher meetings. Although the district expected beginning teacher meetings to be held monthly, Whitney's waned over the course of the school year. As early as the end of first semester, Whitney noticed that her beginning teacher meeting "support kind of dropped off" (follow-up interview, 1/11/2011). As she explained, her beginning teacher meetings were "kind of scarce," with only one of the five beginning teacher meetings she reported during her final interview occurring in the second semester (final interview, 5/16/2011). When the beginning teacher meetings were held, Whitney described them as "informational in some way or another about how something works or how to navigate something or what to expect" (follow-up interview, 1/11/2011), but she admitted that the sequence of topics was sometimes ill-suited to beginning teachers' needs and concerns:

> If I needed help with this, I'd just come ask her. You know, like one time we did grades. Well, I had already posted all my grades because I went and saw her during planning. And one time we, you know, looked at each of our curriculums.

> Well, if you hadn't printed your curriculum out by that point . . . you probably weren't prepared in teaching like you needed to be, so it's just kinda, okay, well shouldn't we have done this already? (final interview, 5/16/2011)

The remaining mandated monthly beginning teacher meetings were incorporated into faculty meetings during the second semester (final interview, 5/16/2011).

During the beginning teacher meeting I observed, Whitney and the other beginning teachers met with the school's induction coordinator and principal to talk about the end of the semester: grades and make-up work, class websites, observations, exams and exam exemptions (observation, 11/30/2010). Whitney's induction coordinator emphasized that the goals for this beginning teacher meeting "were to remind them of the end of the semester, things that they needed to plan ahead for, such as exams, teacher-made exams, what their exam schedule may look like" (interview with Whitney's induction coordinator, 11/30/2010). She wanted the beginning teachers to feel "comfortable in knowing these are some things I can expect. These are some things I should plan on" (interview with Whitney's induction coordinator, 11/30/2010). Additionally, she and the principal emphasized throughout the meeting that they were both available and willing to help the beginning teachers; the beginning teachers needed only to come to the induction coordinator and principal with their questions (observation, 11/30/2011; interview with Whitney's induction coordinator, 11/30/2010).

Overall, Whitney found the meeting "informative, but it was not very detailed, so I felt like we were being told here is what might happen, but don't plan on it just yet" (interview, 11/30/2010). Though she did not expect or need anything from the beginning teacher meeting, she appreciated "them clearing up the information on exams because I had asked those questions a while back" (interview, 11/30/2010).

First semester, when beginning teacher meetings occurred more regularly, Whitney named these meetings as her third most important and impactful support after colleagues and her mentor, respectively (follow-up interview, 1/11/2011). As the school year progressed and beginning teacher meetings became increasingly infrequent, Whitney neglected to name beginning teacher meetings in her top five list of important supports; she, however, identified other beginning teachers as her fourth most important support (final interview, 5/16/2011). From other beginning teachers, Whitney gained "a lot of bouncing off ideas. Oh, can I use that in my room? What, you know, classroom management works for you? What works for me? That kind of thing" (final interview, 5/16/2011).

Summary/interpretation of Whitney's beginning teacher meetings. Like her district-level supports, Whitney's beginning teacher meetings afforded beginning teacher identities-in-practice focused on getting information and knowing and following policies and procedures. The informational tone that the school's induction coordinator set out to establish afforded beginning teacher identities-in-practice as someone who was comfortable in knowing what to expect as the school year progressed. However, as the school year progressed, monthly beginning teacher meetings waned, implying beginning teacher identities-in-practice as someone who did not need sustained support once the school year was underway. Against the backdrop of irregular beginning teacher meetings that were ill-suited to her needs and concerns as a beginning secondary science teacher, Whitney took up identities-in-practice that positioned her as a proactive agent of her own growth and development as a new teacher. While she recognized the informational nature of her monthly beginning teacher meetings, she frequently went to the induction coordinator directly rather than waiting to receive information during meetings. One of her reasons for doing so was because the progression of topics discussed during the beginning teacher meetings was ill-suited for meeting the needs of beginning teachers (final interview, 5/16/2011). A developmental progression of topics in response to beginning teachers' needs (Berliner, 2001; Luft & Patterson, 2002) was not evident, and at times Whitney felt that if she waited for a topic to be covered in the beginning teaching meetings she would be unprepared (final interview, 5/16/2011). If she needed help or had questions, she sought answers to her needs and questions as they arose. Because of this, she did not need or expect anything specific from her beginning teacher meetings.

Additional induction supports. In addition to the district- and school-based supports previously discussed, Whitney was supported by her colleagues and professional learning community, administration, students, the district's content-focused seminars and online instructional resources, and her university's Noyce Program. These supports extended those mandated by the state's beginning teacher support policies.

Colleagues and professional learning community. Into the first semester, Whitney recognized the "great support" she received from her science colleagues: "I've gotten a lot of materials as far as teaching materials, teaching ideas, umm, just planning, you know. Again they're there to kind of bounce ideas off of, which is great" (initial interview, 11/8/2010). When she took over her colleague's biology classes and joined the biology PLC, Whitney appreciated having a sounding board for her ideas, and valued the instructional and emotional support her biology colleagues provided. As she explained,

> Well, I've started doing PLCs with the biology department and so we've been able to kind of brainstorm…and that's really been helpful. Or, just, you know, being able to shoot questions off of them and be like, okay does this sound like a good idea? Does it not sound like a good idea? Umm, so they've been a big help in that and just a big help in mentally supporting me, you know, are you okay? Can I help you with something? You know, are you feeling overwhelmed? That kind of thing, which has been really nice because it's kind of kept me from getting too overwhelmed. (follow-up interview, 1/11/2011)

In fact, Whitney so valued the instructional and emotional support she received from her science colleagues that she consistently named her colleagues as her most important support (follow-up interview, 1/11/2011; final interview, 5/16/2011), emphasizing that without her colleagues and administration she "wouldn't have made it a month" (follow-up interview, 1/11/2011). Though Whitney learned "how to work in any conditions. Umm, I've learned kind of how things flow, how things, you know, how the semester should run, can run. Umm, time management. Planning skills" (final interview, 5/16/2011), she wished for more collaboration among disciplines in the science department, recognizing "that there may be things that people have done or what not that we could all kind of share and, you know, kind of gain from" (initial interview, 11/8/2010).

Weekly biology PLC meetings provided the time and space for Whitney's formal interactions with her biology colleagues. As Whitney's curriculum facilitator, who attended each PLC meeting, explained, the purposes of PLC were "to share ideas, umm, to collaborate and you know, to come up with the best strategies for teaching students" (interview with Whitney's curriculum facilitator, 5/5/2011). Of Whitney's participation in these PLC meetings, her curriculum facilitator underscored that

> Whitney's kind of unique. I think from day one she was participating. Uhh, she's not shy and she has a wealth of ideas. So, she was a contributor and in fact last semester when she had to take over teaching biology when [her colleague] went on maternity leave, she jumped right in and really brought some energy to those meetings. (interview with Whitney's curriculum facilitator, 5/5/2011)

In addition to collaborating during weekly PLC meetings, Whitney and the other biology teachers talked informally about teaching and learning during their common planning period (interview with Whitney's curriculum facilitator, 5/5/2011).

The ways in which Whitney's curriculum facilitator described her participation in PLC meetings were evident in the three PLC meetings I observed (observation, 12/9/2010; observation, 3/10/2011; observation, 5/5/2011). During one of the PLC meetings I observed, Whitney met with the other two biology teachers in her classroom; the curriculum facilitator and principal joined the meeting as well (observation, 3/10/2011). The biology teachers did not have a formal agenda for the meeting. Typically, they would have analyzed students' recent biology benchmark tests; however, one teacher had been sick and still needed to administer her benchmark tests. Though they did not analyze test results, the biology teachers talked about several of the questions with regard to diagrams and wording. During the meeting, Whitney was confident as she talked about the curriculum and her instruction. She was attuned to what her students may and may not know or be familiar with. This was evident when the biology teachers talked about specific benchmark test questions. For example, one particular question confused Whitney's students because of the terminology used: "[T]his [question], with storage, so they think vacuole. And then it says herbicide. My kids don't know what that is. Why can't they just say weed killer? I know it's less complex, but my kids don't know what herbicide is" (observation, 3/10/2011). Additionally, she was confident and comfortable sharing ideas and strategies with her more experienced biology colleagues. One of the teachers discussed her students' difficulties understanding osmosis problems and figuring out the percentages of water and solute in the solution. Whitney shared that color coding the water and solute helped her students:

> I color code my water and sugar. I write my solute in black and my water in blue and we talk about if we have 5% sugar, how much water do we have . . . If you think about solute and solvent, they don't know what those words mean. They should, but they don't . . . Did you guys do the eggs? Maybe you can tie it back to that? (observation, 3/10/2011)

During all of the PLC meetings I observed, Whitney was treated as an equal by her more experienced biology colleagues, the curriculum facilitator, and the principal. Her contributions were heard and valued.

Summary/interpretation of Whitney's supports from her colleagues and PLC. Of the four beginning secondary science teachers in this study, Whitney's supports from her colleagues and PLC were the most robust for fostering beginning science teacher identities-in-practice toward ambitious science teaching practices. Her colleagues and PLC afforded beginning science teacher identities-in-practice as someone who needed and wanted feedback on her instructional ideas, and who had valuable ideas to contribute. Though a first-year teacher, during PLC Whitney was afforded identities-in-practice focused on developing best strategies for teaching her biology students. In developing best strategies and discussing biology instruction with her colleagues, Whitney was also afforded beginning science teacher identities-in-practice focused on using assessment data to make informed instructional decisions. Seemingly effortlessly, Whitney took up and enacted these promoted identities-in-practice: She positioned herself and was positioned by her more experienced biology colleagues as someone who contributed valuable ideas worth listening to and talking about. Moving beyond transmission-oriented practices of Sophia's, Ingrid's, and Jessica's PLCs, Whitney enacted beginning science teacher identities-in-practice as someone who knew she could get taking materials and ideas during PLC, but who also wanted to bounce ideas off her colleagues. That is, Whitney came to PLC *with* ideas, not just *for* ideas. She was agentic in her growth and development as a beginning secondary science teacher.

Colleagues and PLC were invaluable supports for Whitney. She appreciated both the emotional and instructional support they provided, especially during first semester when Whitney took over her colleague's biology classes. In fact, she consistently named her colleagues as her most valuable support (follow-up interview, 1/11/2011; final interview, 5/16/2011).

Since Whitney interacted with her biology colleagues formally during PLC and informally during their common planning, these supports cannot be separated and, rather, must be considered together. While providing personal support and keeping Whitney from getting too overwhelmed (follow-up interview, 1/11/2011), her biology colleagues also provided instructional support. The extent to which Whitney and her biology colleagues shared best practices, analyzed common assessment data, and considered ways to reteach and reinforce content more closely aligned with DuFour's (2004) big ideas for PLCs than did the PLCs of any other participant.

Administration. Over the course of her first year of teaching, Whitney received an "immense amount" of support from her administration, including the school's curriculum facilitator (initial interview, 11/8/2010). The administration and curriculum facilitator were "interested in what's going on" and were frequently visible in her classroom (initial interview, 11/8/2010). In fact, the curriculum facilitator frequently visited Whitney's classroom to do instructional "clips" that informed her of his observations during these brief visits, his thoughts about the instruction, and "they share things as far as the last three times I've been in here this is kind of where your kids have been just to kind of give me a gauge" (initial interview, 11/8/2010). The administration and curriculum facilitator also acknowledged "the good things they see coming out of my classroom" (initial interview, 11/8/2010).

Whitney recognized she could go to the administration and curriculum facilitator with anything she needed (follow-up interview, 1/11/2011). Their interest in what she did and their quick response to her questions and needs helped Whitney realize that "I am important to what they're doing during the day" (follow-up interview, 1/11/2011). She recounted how she felt when the administration helped her solve a problem—what to do since her classroom was not a lab classroom: "They've already managed it, you know, as soon as I expressed a concern, it was, 'alright well let's solve it.' . . . [T]hat was really impressive and nice to know that people were just as concerned about it as I was" (follow-up interview, 1/11/2011). The curriculum facilitator was similarly responsive to her needs. As Whitney explained, “if I ask him for a resource or something he’ll research it and get back to me . . . I maybe teaching and check my email at the end of class and he’s already found what I wanted” (follow-up interview, 1/11/2011).

The support Whitney received from her administration and curriculum facilitator was valuable to her throughout the school year. At mid-year, Whitney related that she “wouldn’t have made it a month” without the support of her colleagues and administration (follow-up interview, 1/11/2011). At the end of the school year, Whitney identified her administration as her fifth most important support after her colleagues, students, the district’s content-focused seminars, and other beginning teachers respectively (final interview, 5/16/2011).

Students. As previously discussed, Whitney was interested in helping her students see the relevance and applicability of the science content she taught (initial interview, 11/8/2010; follow-up interview, 1/11/2011; final interview, 5/16/2011) while also teaching students personal responsibility (final interview, 5/16/2011). Throughout the semester, Whitney maintained a focus on her students and their learning. Given this commitment, it was not surprising that during our final interview Whitney named her students as a significant and important support—number two on her list of top five most important supports (final interview, 5/16/2011). As she explained,

> I’ve gained perspective on kind of like, you know, the good things I do. Some of the things, you know, I could change. My notes, techniques, you know. Some days I have really good notes and they get a lot from them. And other times . . . when I’m making assumptions. I feel like they’re, you know, I could say, you

> know, why was today so hard? Well, you assumed that we understood so-and-so (final interview, 5/16/2011).

Of the beginning secondary science teachers in this study, only Whitney and Ingrid identified their students as a source of support during their first year of teaching; neither, however, discussed the support they received from students until our final interviews.

Summary/interpretation of Whitney's supports from administrators and students. Frequently visible in her classroom and always responsive to her needs, support from Whitney's administration afforded beginning science teacher identities-in-practice as someone who could go to the administrative team with any concerns or questions. The approachability, responsiveness, and visibility of the administration implied beginning science teacher identities-in-practice as someone worth taking an interest in. During her first year of teaching, Whitney took up and enacted these promoted beginning science teacher identities-in-practice: When valid issues arose, such as needing a lab space to teach biology, Whitney took her concerns to the administration who quickly found solutions, such as using a colleague's classroom on laboratory days. This relationship with the administration enabled Whitney to take up beginning science teacher identities-in-practice as someone who was vital to administration's daily tasks and goals. She felt an integral and valuable part of what the administration and school aimed to accomplish on a daily basis.

As previously discussed, administrators should be present, positive, and actively engaged; anticipate the needs of beginning teachers; maintain orderly schools; support classroom management (Johnson & The Project on the Next Generation of Teachers, 2004); and support the goals of induction and those who assist and mentor beginning teachers (Bartell, 2005). Whitney's administration and curriculum facilitator provided these supports, making her feel like a greatly valued member of the school team. Working together to support Whitney and the school's other beginning teachers, her administration and curriculum facilitator not only understood her needs (Moir, 2005), but responded in a timely and positive manner as well (follow-up interview, 1/11/2011).

Like Ingrid, the support Whitney received from her students afforded particular beginning science teacher identities-in-practice. In addition to gauging students' reactions to determine whether they enjoyed a particular activity, Whitney further reflected on students' reactions and responses to determine the ways in which she might have made assumptions about students' science understandings. Her interactions with and support from students afforded beginning science teacher identities-in-practice as someone who gained perspective from students regarding assumptions she made about their understandings, and judged her teaching techniques and strategies based students' reactions. Whitney took up and enacted these promoted beginning science teacher identities-in-practice, and also enacted identities-in-practice as someone who carefully and purposefully reflection on students' reactions and responses with thinking about the success of lessons and how to improve lessons in the future.

Since beginning teachers' concerns initially center on themselves rather than their students and students' learning (Fuller, 1969), it is surprising that Whitney, like Ingrid, discussed her students as a support during her first year of teaching (final interview, 5/16/2011). Throughout the school year, Whitney maintained a student-centered approach to her teaching, frequently taking students' reactions to her teaching into account when reflecting on lesson and planning future lessons.

Content-focused seminars and online resources. The collaboration and exchange of ideas that Whitney valued in her biology PLC were the reasons she appreciated the district's monthly content-focused seminars as well. During first semester, Whitney attended the earth/environmental science seminars until she started teaching her colleague's biology classes; at that point and throughout second semester, Whitney attended biology and earth/environmental science seminars.[23] She recounted both sharing and gaining ideas and resources during the content-focused seminars. Mid-way through the first semester, Whitney reflected on her participation in biology seminars during her student teaching, and earth/environmental science seminars during her first semester of teaching:

> But especially even as a student teacher, going, which most student teachers didn't go . . . especially in the beginning or the end when you're like, okay, what's going on in our classrooms right now, I found myself sharing a lot of things and people kind of going, oh that's a cool idea or, oh, you know. But I was also gaining a lot from those as well . . . I have found that at the earth and environmental I'm not giving as much, but I think that's to because I'm just trying to soak as much in. I do know that in either February or April I will be presenting at a Teaching and Learning, I'm going to co-present with the, umm, other teacher that I plan with here, but umm, I'm really excited about that and trying to, you know, have incorporate what I'm already doing once so that I can have mastered it a little bit better. (initial interview, 11/8/2010)

[23] Whitney attended the district's biology-focused seminars during her student teaching as well. After her student teaching requirements were met, Whitney took over as the long-term substitute in the class while her on-site teacher educator was on maternity leave. During her student teaching semester, Whitney frequently attended the seminars with her on-site teacher educator.

During our initial interview, Whitney revealed her confidence in creating or applying meaningful assignments for her students (initial interview, 11/8/2010). Such meaningful assignments came from Whitney's colleagues, the district's content-focused seminars, or the district's online instructional resources (initial interview, 11/8/2010).

Whitney gained "new classroom techniques. Better ways to teach what I teach, you know . . . And then just other ways I can teach concepts" from participating in the district's content-focused seminars. Toward the end of the school year, Whitney identified the content-focused seminars as her third most important support following her colleagues and students, respectively (final interview, 5/16/2011).

Though the district's content-focused seminars lulled after the winter break (follow-up interview, 1/11/2011), I was able to observe Whitney, along with Sophia and Ingrid, during the February earth/environmental science seminar. As discussed in Sophia's and Ingrid's cases, teachers shared various activities—NASA teaching module, "Sum of the Parts" activity from Project WET (1995), various ocean currents activities—during this meeting (observation, 2/21/2011). During the meeting, Whitney interacted with both the presenting and participating teachers, confident in her content and pedagogical knowledge, and eager to gain ideas she could use in her teaching. As she participated in various activities, she thought about ways to incorporate the presented materials and ideas into her own teaching. Whitney seemed most eager about the "Sum of the Parts" activity, which she used first semester.[24] She talked with and shared ideas, such as reading *Journey to the Center of the Earth,*[25] with other teachers at her table.

Whitney thought that this earth/environmental science seminar "had some valuable pieces"; however, similar to Ingrid, Whitney did not perceive the applicability of all the presented activities to her own classroom (interview, 2/22/2011). As she highlighted, "but again like other [seminars] I felt like it was a lot of showboating about grants and such, and not stuff that is applicable to low level classes, which most earth/environmentals are" (interview, 2/22/2011). Hoping "to get some ideas about technology and maybe an activity or two that I could apply to my class," Whitney felt she gained what she needed from the seminar "so I was happy" (interview, 2/22/2011).

Whitney planned to co-present with an earth/environmental science colleague during the April seminar (initial interview, 11/8/2010). From presenting at the seminar, Whitney learned "a lot about well if you said it this way it may help them not miss this concept, or if you clarified this word" (final interview, 5/16/2011).

Summary/interpretation of support from content-focused seminars and online resources. As they did for Sophia and Ingrid, the district's content-focused seminars afforded Whitney dual beginning science teacher identities-in-practice. Due to the nature of the content-focused seminars—all science teachers were expected to attend the seminars for their discipline, and the district's secondary science curriculum coordinator asked particular science teachers to present ideas, activities, and lessons at each month's

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[24] Whitney was introduced to the "Sum of the Parts" activity during the earth/environmental science resource exchange organized by her university's Noyce Program. This resource exchange was held 11/10/2010.

[25] Verne, J. (2008). *Journey to the center of the earth.* New York, NY: Pocket Books.

meeting—afforded identities-in-practice focused on science teachers as needing to continually learn about effective science teaching practices and activities while also positioning science teachers as sources of these practices and activities. In addition to being positioned as learners, some science teachers were also positioned as instructional leaders with valuable ideas to share. The fact that content-focused seminars were discipline-specific also afforded beginning science teacher identities-in-practice that acknowledged the need for content-focused instructional support. During the district's content-focused seminars, Whitney took up beginning science teacher identities-in-practice as both a learner and a leader. That is, she both gained and contributed science teaching ideas during the monthly seminars. As during her PLC meetings, Whitney came to the content-focused seminars with, not just for, ideas. Relative to the ideas she gained during the seminars, Whitney enacted beginning science teacher identities-in-practice as someone who adapted and modified others' ideas to her specific context and students.

At the start of the school year, Whitney was confident in her ability to apply learning activities in her classroom (initial interview, 11/8/2010). The district's content-focused seminars and online instructional resources provided some of the activities she applied in her lessons. Having participated in the district's biology-focused seminars during her student teaching, Whitney was comfortable and confident to both participate in and contribute to these meetings. She recognized that not all shared resources and activities were directly applicable to her teaching context, but considered ways to modify the resources and activities for her classes.

Noyce support. As a Noyce teacher, Whitney had access to the same Noyce supports that Jessica did. Since those supports were previously described in Chapter III, I do not describe them again here; rather, I discuss the ways Whitney accessed and engaged with those supports.

Like Jessica, Whitney did not draw heavily on the Noyce support available to her. In an informal conversation at the start of the school year, Whitney mentioned wanting help with earth/environmental science resources. Since she prepared to be a biology teacher, but taught all earth/environmental science during her first semester of teaching, she was concerned about the teaching resources she had and knew of. In response to the needs and concerns of the Noyce teachers, I arranged a resource exchange with an experience earth/environmental science teacher (11/10/2010). Whitney and another Noyce teacher in her cohort attended this resource exchange.

Whitney accessed more instructional supports from her Noyce Program than did Jessica. She and I frequently discussed her past and future lessons either before or after our scheduled observations and interviews. She told me about the class activities she created and/or planned and was frequently proud of her science instruction. On one occasion, Whitney was dissatisfied with an upcoming lesson, and involved me in revising her lesson plan for the next day. Observing her for my dissertation study put me in a unique position to help her do this. I observed several lessons in her instructional unit and, through our post-observation interviews, came to understand her instructional goals. This information served me well as we worked to plan her upcoming lesson.

With access to the same forms of support from her university's Noyce Program, Whitney was afforded similar beginning science teacher identities-in-practice as Jessica. The science-focused individual support I provided as project coordinator at the time afforded beginning science teacher identities-in-practice as someone with unique and time-sensitive needs. Additionally, Whitney's Noyce supports afforded beginning science teacher identities-in-practice as someone who needed supports that enabled and allowed for effective science instruction. As noted in Jessica's case, each Noyce teacher could take advantage of these supports in various ways and to varying extents. Jessica, for example, did not draw on the science-specific aspect of the offered Noyce supports during her first year of teaching; Whitney, however, did. Within the context of supports from her university's Noyce Program, Whitney took up beginning science teacher identities-in-practice as someone who sought and accessed various supports to gain materials, activities, and resources that she thought would enhance her science teaching and her students' science learning. This was evident in Whitney's request for and attendance at the earth/environmental science resource swap I arranged for the Noyce teachers (11/10/2010). In our conversations about her teaching materials and science instruction, Whitney took up beginning science teacher identities-in-practice as someone who was proud of the instructional materials and activities she developed for and used in her science teaching, and who revised unsuccessful or dissatisfying lessons by talking about her science teaching with someone with content knowledge and science teaching experience. Specific to her Noyce supports, Whitney talked with me about her ideas for science activities and lessons. Here again emerged the theme of colleagues and supports as “sounding boards” that was evident in Whitney’s interactions with her mentor and colleagues.

Neither Jessica nor Whitney discussed the supports they received from their Noyce Program unless specifically asked about Noyce supports.

Summary/interpretation of Whitney’s induction experiences. Of the various induction supports Whitney had access to as a beginning secondary science teacher, she most greatly valued her colleagues who provided her with immensely valued emotional and instructional support. (See Table 12 for a summary of the identities-in-practice afforded by and taken up during Whitney’s induction supports as well as the meanings she made of each support.) Through collegial relationships and interactions, Whitney not only gained valuable information, ideas, and support from her colleagues, but she provided ideas and support to her biology colleagues as well. Breaking from a transmission model of support, the exchange of ideas among Whitney and her biology colleagues was multidirectional: She contributed ideas as important and valued as the ones she gained. Whitney and her biology colleagues positioned themselves and were positioned by one another as knowledgeable peers, providing one another with procedural, emotional, and instructional support. Given this, Whitney’s interactions with her colleagues during PLC afforded beginning science teacher identities-in-practice focused on professionalism, collaboration, and instructional leadership. These identities-in-practice were broader than those afforded to, and subsequently taken up by, other participants in this study.

Table 12. Summary of Whitney's Induction Experiences

Induction Supports	Beginning Science Teacher Identities-in-Practice: Afforded	Beginning Science Teacher Identities-in-Practice: Taken Up	Meanings Made
District-level supports	Orientation: As someone focused on policies and procedures Induction and success coach: As someone focused on policies and procedures; as worthy of Rookie Teacher of the Year nomination; as someone who needed support completing Rookie Teacher of the Year nomination paperwork	As someone who knew and followed policies and procedures; who was knowledgeable to district-level supports; who drew on experiences of her support providers as needed	Induction and success coach was good "as needed" support
Mentor	As someone who did not need regular, continued, and structured support from mentor; who recognized the limits of mentor support; who knew other supports to draw on other than her mentor	As someone who was personally driven and could be successful without regular mentor support; who was collegial with her mentor and used her mentor as a sounding board for ideas; who recognized the limits of mentor support and sought biology-specific support from her biology colleagues; who was agentic	Comfortable and confident talking with mentor about her ideas, but, with infrequent meetings and a mismatch of content areas, her mentor was a particularly important support
Beginning Teacher Meetings	As someone who focused on policies and procedures; who needed to be given information; who did not need sustained support into 2nd semester	As someone who was proactive in getting her questions answered; who did not expect anything specific from the meetings	Meetings were informative, but not detailed; not well suited to beginning teachers' needs, so sought additional information rather than waiting for topics to be discussed during meetings

Table 12 (cont.)

Induction Supports	Beginning Science Teacher Identities-in-Practice: Afforded	Beginning Science Teacher Identities-in-Practice: Taken Up	Meanings Made
Colleagues and PLC	As someone who wants and needs feedback on her instructional ideas; as a contributor of valuable ideas; as someone with a vital role in coming up with best strategies for teaching science; as someone who used assessment data to make informed instructional decisions	As someone who can gain teaching materials and ideas from colleagues, but who can also bounce ideas off colleagues and contribute valuable ideas; who was a colleague (rather than less-experienced other); who comes to PLC with ideas rather than to just get ideas; who was agentic	Excellent emotional and instructional support; most beneficial support
Administrators and Students	Administrators: As someone who could go to administrators with any questions or concerns; who was worth taking an interest in Students: As someone who gained perspective from students about assumptions of their understandings; who judged teaching techniques and strategies based on students' reactions	Administrators: As someone who could go to administrators with questions and concerns; as vital administrators' daily goals and routines Students: As someone who was reflective on students' reactions/responses when thinking about the success of lessons	Administrators were a great support and were invested and interested in her success
Content-Focused Seminars and Online Resources	As someone who needed to learn more about best practices and effective teaching activities, but also as an instructional leader with valuable ideas to share; as someone who recognized the value of and needed content-focused support	As someone who gained and contributed ideas at seminars; who adapted other's ideas to suit her context and students	Valuable for gaining new ideas that she could adapt and use; could be both a learner and a leader

Table 12 (cont.)

Induction Supports	Beginning Science Teacher Identities-in-Practice: Afforded	Beginning Science Teacher Identities-in-Practice: Taken Up	Meanings Made
Noyce	As someone with unique and time-sensitive needs; as someone needing supports focused on science instruction	As someone who accessed various supports to get ideas; who was proud of the instructional materials and activities she developed; who revised unsuccessful lessons by talking with someone with content knowledge and experience	(Interpretations based on observations and interactions; Whitney did not specifically discuss Noyce supports beyond mentioning them as a possible source of support during our initial interview)

Whitney's enacted beginning science teacher identities-in-practice as someone who both gained from and contributed ideas to colleagues at the school and district level were also evident in her participation during the district's content-focused seminars. Unlike Sophia who was determined to gain something from every support or Ingrid who was skeptical that any ideas or materials could be effective in her specific context, Whitney was intentional in the ideas, materials, and resources she gained from induction supports such as the district's content-focused seminars. Whitney recognized that in order to use the ideas, materials, and resources gained from her induction supports she would need to adapt the ideas, materials, and resources to suit her students and context, doing so in ways that aligned with her vision for science teaching of allowing "students to be able to realize the connections between science and everyday life" (initial interview, 11/8/2010). In the context of the content-focused seminars, as in PLC, Whitney also enacted beginning science teacher identities-in-practice as an instructional leader. During the April content-focused seminar, Whitney and an earth/environmental science colleague presented teaching activities that they and the district's science curriculum specialist thought were effective.

More so than with other participants in this study, Whitney's induction supports afforded, and she took advantage of and enacted, beginning science teacher identities-in-practice that enabled and nurtured a more robust meaning of science teacher than transmission models of induction allowed. Because of this, Whitney knew she was a valuable member of her biology PLC, science department, school, and district as she drew on the personnel and supports across these levels to continue her development as an instructional leader. Not only did Whitney's context and support make this possible, they likewise did not strip her of agency as a beginning science teacher. While she could have participated in more transmission-type ways—and some of her supports, such as beginning teacher meetings, were set up in this way—she was not confined to such identities-in-practice. For example, even within the context of informational beginning teacher meetings, Whitney was proactive in recognizing her needs and actively seeking help if her needs as a beginning teacher were not being met as they arose: She printed and read her curriculum before it was distributed in a beginning teacher meeting; she sought help with the state's online grade book program before it was discussed at the end of the first grading period. This agency was perhaps the most distinguishing characteristic between the identities-in-practice afforded to and enacted by Whitney and those afforded to and enacted by Sophia, Ingrid, and Jessica.

Identities-in-Practice Enacted by Whitney while Teaching (Research Question 2)

In the contexts of her induction supports, Whitney was afforded and took up beginning science teacher identities-in-practice centered on gaining from and contributing to collegial interactions, and reflecting on the effectiveness of her teaching. She positioned herself and was positioned by others as someone with valuable science teaching ideas that contributed to her effective teaching. That she critically and actively engaged in induction supports that were science focused—mentoring, PLC, content-focused seminars—provided identities-in-practice that were more nurturing and enabling of robust science teaching identities-in-practice was apparent in her classroom science teaching and the identities-in-practice she enacted while teaching.

I observed Whitney two times during first semester. In each case, I observed her earth/environmental science class[26] (observation, 12/7/2010; observation, 12/8/2010). During the first observation, Whitney's students engaged in primarily independent, self-guided activities focused on the water cycle: journal entry, vocabulary flashcard, notes, and review questions from the textbook. Whitney and the substitute circulated among students to check for understanding, monitor progress, and regulate noise levels. From time to time, Whitney and the substitute talked with one another about the topics they would cover and the instructional activities they would use in future classes as well as the challenges Whitney faced in taking over her colleague's biology classes. Whitney

[26] The earth/environmental science classes I observed technically occurred during Whitney's planning period for the classes she took over for her biology colleague. A substitute taught Whitney's two other earth/environmental science classes and assisted during the section I observed. They frequently discussed activities and ideas so the substitute could use the teaching activities the next day with the other two sections. Given this arrangement, Whitney taught four straight block-schedule classes during the school day.

envisioned having "students be self-sufficient and allow them to get the basic ideas behind the water cycle and how it works" during this lesson (interview, 12/7/2010). Though she hoped students would have more "'aha' moments," she liked "introducing this as individuals. That way, then throughout it we can tie together ideas and concepts until we reach the final product" (interview, 12/7/2010).

Whitney's vision of showing students the relevance and applicability of the science content she taught was evident in the instructional activities she included in her teaching. The following day, Whitney's class focused on global water usage and water pollution (observation, 12/8/2010). More involved than during the previous lesson, Whitney presented a mini-lecture on global water usage then guided students through the "Sum of the Parts" activity in which students developed a plot of land, traded their plots with a classmate who identified potential sources of pollution, and visualized the effects of pollution in a river. She envisioned "the kids really getting involved and feeling connected [to] their land and kind of connection the information . . . I also thought they might appreciate something a little different" (interview, 12/8/2010). With a student-centered focused, it was no surprise that Whitney enjoyed being able to interact with her students during this activity. As she explained, "sitting with the students and talking as they surrounded the table was a cool feeling for be because it kind of allowed me to feel like we were really talking" (interview, 12/8/2010).

Since this was the first time Whitney used this activity, she reflected on her students' engagement and understandings to find ways to improve for the future. For the next time she taught the activity—her substitute planned to teach the activity the following day during Whitney's other two sections of earth/environmental science—she "hope[d] to be a little more prepared in the way I present it: the aerial view and handout out the pollution" (interview, 12/8/2010). The next semester that she used the "Sum of the Parts" activity, Whitney hoped for "more student-led discussion—students making points and asking questions" (interview, 12/8/2010). Next school year when she used the activity, she hoped to have an "even better presentation—maybe use it as an engage activity to introduce water and its importance" (interview, 12/8/2010). In referencing an "engage activity" here, Whitney drew from her secondary science methods course, as course I taught. Drawing on and learning from various aspects of her teacher preparation and professional development were evident as Whitney reflected on her teaching throughout the school year.

During second semester, I observed Whitney's fourth block biology classes. During my second observation of the new semester, evidence of the administrative support Whitney discussed was clear: For an organic compounds lab, Whitney took her class to a colleague's empty laboratory classroom (observation, 2/1/2011). Though the seven classes I observed second semester never followed exactly the same format, Whitney actively involved her students in whole-group and small-group learning activities. Below, I discuss representative benchmark and investigation lessons (Krajcik, Czerniak, & Berger, 2003).

During a representative benchmark lesson, students answered a set of practice EOC questions for their bell ringer, watched a video on natural selection and evolution, and created imaginary birds as port of the "Adaptation Artistry" activity from Project

WILD (1995). Incorporation of "Adaptation Artistry" into her teaching was another way in which Whitney drew on her teacher preparation; I introduced her and her classmates to this activity in the secondary science methods course. To start this class, as with other classes I observed, Whitney gave her students a bell ringer assignment. In Whitney's classes, the type of bell ringer assignment varied by day of the week. Since it was Friday, students worked on five practice EOC questions that focused on classification, a topic students recently learned about in class. When students finished with the bell ringer, Whitney reviewed the answers by having students indicate their answer choices by holding up a corresponding number of fingers. Answer choice A was represented by 1 finger, B by two fingers, C by three fingers, and D by four. After students indicated their answers, Whitney discussed the questions and answers with the class. This discussion extended beyond simply stating the correct answers to why those answers were correct. Following discussion of the bell ringer, students watched a video on natural selection and evolution. Whitney asked questions during the video to focus students' attention and check for understanding. Next, Whitney reviewed the major concepts presented in the video and introduced the "Adaptation Artistry" activity. Using a sheet of adaptation choices, students created an imaginary bird. To end class, Whitney returned and answered questions about a recent quiz on the kingdoms and passed out students' homework assignment (observation, 5/6/2011).

Whitney envisioned this lesson to "kind of tie up any loose ends" (interview, 5/6/2011). The class had discussed evolution for a week, and she "wanted to tie up any loose ends, any misconceptions, and then do a little bit more detail with speciation and, you know, new species and then survival of the fittest within those new species" (interview, 5/6/2011). Whitney felt she was successful in tying up loose ends, emphasizing "I think they were able to gauge a little bit of what they get and what they don't get" (interview, 5/6/2011); however, her class was only halfway through the activity on natural selection and speciation. Whitney discussed her plans for the remainder of the activity:

> [T]hey've done the speciation to where they've created a new bird species, but they haven't put them into an environment to see if they can survive . . . [H]opefully I will come up with a way to create different environments for them to have their birds placed in. So, a water environment, a desert environment, a woods environment, and then they'll draw a random number that'll send them to that environment, and there'll be a list of like the environment has this. If you chose these characteristics, your bird can't survive, or your bird thrives . . . And I also have to figure out if it's worth possibly spending another half of a day at this point, or if it's something I want to make note to do next semester. (interview, 5/6/2011)

Whitney also discussed sequencing her notes to follow the video or using only segments of the video "after or before my notes and so they're not gonna watch the whole 20 minute video at one time as a review, but more as like either an intro or a review at the end" (interview, 5/6/2011). Though she would use it differently in the future, Whitney planned to continue using the natural selection and evolution video.

During a representative investigation lesson, Whitney reviewed photosynthesis and cellular respiration with her students, showed them a demonstration for anaerobic respiration, and engaged them in an activity on the effects of exercise on the rate of aerobic respiration (observation, 3/3/2011). Throughout the various class activities, Whitney remained patient and positive with her students. She answered their questions concerning the activity procedure and content, and asked them questions to push their thinking about the big ideas of photosynthesis and cellular respiration. Throughout the class period, students responded well to her instruction and directions. For the anaerobic respiration demonstration, Whitney added warm sugar water to yeast and covered the mouth of a flask with a balloon. The balloon was supposed to inflate with the carbon dioxide byproduct, but took a while to do so. Whitney remained calm during this time and asked her students what was supposed to happen during the demonstration. After a few minutes, the balloon began to inflate and Whitney asked her students questions about what was taking place in the flask. After the demonstration, Whitney and her students moved on to the aerobic respiration activity. Students explored the effects of exercise on the rate of cellular respiration and comparing these rates between boys and girls. Whitney distributed the lab materials and talked students through the procedure. The first part of the lab, which did not require students to exercise, was completed in the classroom. Students exhaled into their test tubes while their partners timed how long it took for a color change to occur in the indicator, bromothyml blue, in their test tubes. The second part of the lab required that students run around for a few minutes before exhaling into their test tubes. For this part, Whitney took her students into the new commons area. The class then returned to the classroom to get class averages for the reaction times of boys and girls. Whitney led her students through a discussion of the activity and cellular respiration; class ended with a brief quiz (observation, 3/3/2011).

For this lesson like most lessons, Whitney wanted students to

> be able to understand the concept and how it applies to them. But, today especially I wanted them to have a personal experience either watching the reaction take place or being a part of the reaction, to be able to talk about what happens in cellular respiration, and how it's connected to photosynthesis, and better understand that all cells do respiration. (interview, 3/3/2011)

In thinking about her visions for this same lesson in the future, Whitney admitted that "having the, as always, a lab space will be hugely influential for how well my labs go from here on out;" however, she would retain doing parts of the lab in different locations—"sitting in your desk versus running outside"—because she thought it helped students draw better connections (interview, 3/3/2011). She also recognized that with practice she would feel "a bit more confident in what I'm doing so, you know, knowing and making notes, you know. Use this much time for that. Being able to kind of flow through things a little bit quicker" (interview, 3/3/2011).

As was observed during Whitney's mentor/mentee meeting, she frequently reflected on her teaching and students' learning, often without much, if any, prompting. For example, Whitney taught her students about plants during my final observation (observation, 5/16/2011). After completing and reviewing their bell ringer, students used their textbooks to complete a set of notes on plants. During this time, Whitney circulated around the classroom to answer students' questions. After twenty minutes, Whitney reviewed the correct answers with students. Students' notes discussed alternation of generations, nonvascular and vascular plants, types of vascular plants, and the structure of leaves and flowers. Much of the discussion on plants was facilitated using the overhead projector; however, toward the end of the discussion, Whitney dissected and distributed flowers she had on her desk, flowers she had forgotten were there and did not originally plan to use in this lesson. This demonstrated that Whitney not only reflected on her teaching actions, but in action as well (Bartell, 2005). Whitney explained that she wanted students to connect their school science learning to everyday life much like she connected her lesson to the vase of flowers on her desk:

> Today's lesson [on plants] really dealt a lot with things that I haven't even slowed down to kind of look at and want to understand. And then just in passing realized, oh I have a perfect example [a vase of flower] of exactly what we're learning today sitting right in front of me, you know . . . And so that realization is what I want them to see, you know. When they go to describe, well, I, you know. They were talking about, so is the plant dead? Well, yes and no, and we were able to talk about why, you know. I want them to be able to explain, well Mom if you add water to that plant it may come back because really the cells just, there isn't enough pressure in the cell to hold it up . . . Or they may say, I know why that plant looks dead, you know, and there were a few of them today . . . I feel like a lot of times today with the way things were coming up they wanted to know more. They wanted more detail and unfortunately today I couldn't give it to them, but you know, it might be something that they're kind of like, I'm curious about that now. (final interview, 5/16/2011)

Summary/interpretation of identities-in-practice enacted by Whitney while teaching. Unlike narrower identities-in-practice focused on transmission, the beginning science teacher identities-in-practice afforded Whitney by her induction supports positioned her as a competent and effective professional capable of iteratively benefiting and benefiting from her administrators, colleagues, and students. Not only did Whitney take up these promoted identities-in-practice within the contexts of her supports, but she enacted similarly agentic identities-in-practice during her classroom science teaching. More so than for other study participants, the beginning science teacher identities-in-practice afforded to and enacted by Whitney in her induction supports and classroom science teaching more closely aligned with the robust, ambitious science teaching advocated by science education literature (Windschitl et al., 2011).

Cross-Case Analysis

Though there is overwhelming support for induction programs and supports in districts and schools, not only can these programs take on many forms with great variation among programs (Smith & Ingersoll, 2004; Villani, 2002), but the experiences of Sophia, Ingrid, Jessica, and Whitney illustrated that the implementation of induction programs can take on diverse forms across schools within the same district. Below, I discuss district-level, school-based, and additional supports across my four participants, as well as address beginning teacher support as a priority within schools.

District-Level Induction Supports

Across all interviews in which I asked participants to recount the various ways in which they had been supported as beginning secondary science teachers, only Sophia named district orientation, and only during our initial interview (9/28/2010). Though Sophia appreciated meeting other beginning science teachers from across the district, none of the other participants discussed district orientation, which afforded each participant beginning science teacher identities-in-practice centered on knowing and following policies and procedures. Similar identities-in-practice were afforded by the support Sophia, Ingrid, Jessica, and Whitney received from their induction and success coach. Relying on them primarily for emotional support and help with compiling their professional files, Sophia, Ingrid, Jessica, and Whitney did not heavily draw on the induction support offered by their induction and success coaches. See Table 13 for a comparison of the identities-in-practice afforded by and enacted during participants' district-level support as well as the meanings they made of district orientation and their induction and success coaches.

Table 13. Comparison of Identities and Meanings during District Supports

Components of Identity Model	Participants			
	Sophia	**Ingrid**	**Jessica**	**Whitney**
Identities Afforded	Orientation: As someone focused on policies and procedures Induction and success coach: As someone who needed positive feedback on her teaching	Orientation: As someone focused on policies and procedures Induction and success coach: As someone who needed general strategies to facilitate instruction	Orientation: As someone focused on policies and procedures Induction and success coach: As someone focused on professional files	Orientation: As someone focused on policies and procedures Induction and success coach: As someone focused on policies and procedures; as worthy of Rookie Teacher of the Year nomination; as someone who needed support completing Rookie Teacher of the Year nomination paperwork
Identities Enacted	As someone who knew and followed policies and procedures; who sought something useful from supports and meetings	As someone who was skeptical of advice from an "outsider;" who refused help from someone outside of her school and content area	As someone who knew and followed policies and procedures; who completed professional files	As someone who knew and followed policies and procedures; who was knowledgeable to district-level supports; who drew on experiences of her support providers as needed

Table 13 (cont.)

Components of Identity Model	Participants			
	Sophia	**Ingrid**	**Jessica**	**Whitney**
Meanings Made	Orientation was a repeat of her teacher preparation program Induction and success coach was a cheerleader who did not offer feedback that made her teaching more effective	Did not give induction and success coach much credit and thought she did not know what she was talking about; did not try most of her ideas or value the support she offered	Induction and success coach's support appreciated when compiling professional files	Induction and success coach was good "as needed" support

Though provided by the district to all content teachers thus not specifically part of their induction program per se, beginning teachers found the district's content-focused seminars more meaningful than they did other district-level supports. Ingrid, who maintained that the activities and resources presented in these seminars were inapplicable to her school and classroom contexts, enacted skeptical identities-in-practice; however, Sophia, who aimed to gain something of use from each of her supports, and Whitney recognized opportunities to incorporate and build from ideas and activities presented in the content-focused seminars. Whitney found these seminars to be more beneficial than did the other beginning secondary science teachers in this study, possibly owing to the fact that she participated in and contributed to these seminars while she was a student teacher, and planned to present at a seminar as a first-year teacher. For Whitney, the district's content-focused seminars afforded beginning science teacher identities-in-practice that positioned her and enabled her to position herself as someone who should continue growing and developing as a science teacher, but who also had ideas that could likewise help others improve as science teachers. With the exception of content-focused seminars for Whitney, and to a lesser extent Sophia, less relevant and applicable induction experiences as well as those centered on transmitting information, such as district-level supports, were perceived as less impactful than some of the school-based supports that centered on dialogue about instruction. See Table 14 for a comparison the identities-in-practice afforded by and enacted during participants' content-focused seminars as well as the meanings they made of the seminars.

Table 14. Comparison of Identities and Meanings during Content-Focused Seminars

Components of Identity Model	Participants			
	Sophia	**Ingrid**	**Jessica**	**Whitney**
Identities Afforded	As someone who needed to learn more about best practices and effective teaching activities, but also as an instructional leader with valuable ideas to share; as someone who recognized the value of and needed content-focused support	As someone who needed to learn more about best practices and effective teaching activities, but also as an instructional leader with valuable ideas to share; as someone who recognized the value of and needed content-focused support	[a]	As someone who needed to learn more about best practices and effective teaching activities, but also as an instructional leader with valuable ideas to share; as someone who recognized the value of and needed content-focused support

Table 14 (cont.)

Components of Identity Model	Participants			
	Sophia	**Ingrid**	**Jessica**	**Whitney**
Identities Enacted	As someone who gained from every support in which she participated; who saved time by accessing and modifying	As someone skeptical of whether the information presented would be applicable to her context		As someone who gained and contributed ideas at seminars; who adapted other's ideas to suit her context and students
Meanings Made	Great support for effective teaching because resources could be modified to suit her students; eased the stress of her first year of teaching	Of no help and had no impact on her teaching; information could not be used in her specific context without first being modified		Valuable for gaining new ideas that she could adapt and use; could be both a learner and a leader

[a]Jessica did not attend the district's chemistry-focused seminars because they occurred during her tutoring time.

School-Based Induction Supports

More contextual, and thus perceived as more relevant and applicable, induction supports were school-based. While many of the messages the beginning secondary science teachers received from their district-level induction supports about the meanings of "science teacher" centered on policies and procedures, their school-based supports offered meanings of "science teacher" that focused more on instruction. Instructional messages about "science teacher" and "science teaching" came particularly from the beginning secondary science teachers' colleagues.

The most common time and space for Sophia, Ingrid, Jessica, and Whitney to interact and collaborate with their colleagues occurred during PLC. While school-based supports (i.e., mentors, induction coordinators, beginning teacher meetings) differed from teacher to teacher, especially with regard to sustainability of these supports, PLC meetings offered the greatest point of variance. For example, Jessica did not participate in a content-specific PLC; rather, she attended PLC with other teachers who shared her planning period. In this regard, Jessica's PLC afforded the narrowest and limited beginning *science* teacher identities-in-practice. Though Jessica valued the professional development she received during PLC, her only science-focused support was during collaborative planning meetings during which she worked and planned with her chemistry colleague. Sophia, on the other hand, participated in her earth/environmental science PLC, but it only served a planning function. They did not analyze data or discuss ways to ensure the learning of all students, thus affording beginning science teacher identities-in-practice focused on planning and dividing tasks related to planning. Though Sophia wished her PLC aligned more closely with DuFour's (2004) "big ideas" of PLC, she nonetheless enacted the promoted identities-in-practice. Ingrid and Whitney, on the other hand, participated in PLC meetings that analyzed common assessment data, discussed best practices, and worked toward ensuring the learning of all students. Within the context of their PLC meetings, however, Whitney participated more fully. Whitney was afforded and took up beginning science teacher identities-in-practice centered on receiving and providing feedback on instructional ideas. Though Ingrid was afforded similar identities-in-practice, she enacted identities centered on a transmission model.

That is, she attended PLC to get information, ideas, and activities; once she received these things, she was satisfied. Neither Ingrid nor Whitney participated in PLC for their non-tested subject; they only participated in PLCs for biology. See Table 15 for a comparison of the identities-in-practice afforded by and enacted during participants' PLC meetings as well as the meanings they made of PLC.

Table 15. Comparison of Identities and Meanings during PLC

	Participants			
Components of Identity Model	**Sophia**	**Ingrid**	**Jessica**	**Whitney**
Identities Afforded	As someone focused on instructional planning and dividing tasks with colleagues	As someone focused on planning and using data to inform instructional decisions; as needing to continue to gain new ideas, but as having new ideas to share with colleagues; as instructional leaders	Collaborative Planning: As someone who planned with subject-like colleagues; who asked for and received help; who followed more experienced teacher's lead PLC: As someone who benefitted from general, top-down support; who needed to be aware of school and district initiatives	As someone who wants and needs feedback on her instructional ideas; as a contributor of valuable ideas; as someone with a vital role in coming up with best strategies for teaching science; as someone who used assessment data to make informed instructional decisions

Table 15 (cont.)

Components of Identity Model	Participants			
	Sophia	**Ingrid**	**Jessica**	**Whitney**
Identities Enacted	As someone focused on planning sequence of instructional topics and activities; as someone who shared and gained ideas; who divided work with colleagues	As novice who sought information from others (focused on transmission of information); as passive participant	Collaborative Planning: As someone who could and did go to colleagues with questions; who always taught the same topics her colleague did; who used teacher materials from colleague; who needed less help as she gained experience PLC: As someone who attended meetings as expected; who appreciated administrations support via PLC meetings	As someone who can gain teaching materials and ideas from colleagues, but who can also bounce ideas off colleagues and contribute valuable ideas; who was a colleague (rather than less-experienced other); who comes to PLC with ideas rather than to just get ideas; who was agentic
Meanings Made	Recognized that her PLC was struggling to be a "true" PLC; PLC served a sharing, planning function she appreciated; division of work was helpful	Helpful to a beginning teacher because they "feed her all sorts of resources"	Collaborative Planning: Most important support because could talk about chemistry everyday with colleague PLC: Gained ideas and activities related to cooperative learning that were useful in her classroom	Excellent emotional and instructional support; most beneficial support

Beginning teacher meetings were also a point of contrast among the beginning secondary science teachers in this study. Sophia's weekly beginning teacher meetings most closely aligned with the purposeful, progressive nature of such meetings discussed in the literature (Berliner, 2001; Hammerness et al., 2005), positioning her and enabling her to position herself as someone whose needs understandable and expected change over time. Jessica's beginning teacher meetings occurred on a monthly basis and responded to the needs of beginning teachers at her school; however, they were more procedural than instructional in nature. Within the context of her beginning teacher meetings, Jessica was afforded and she enacted beginning science teacher identities-in-practice as someone who asked and answered questions, and had valuable experiences to share with her peers. During the meetings, Jessica's familiarity with the school's schedule, policies, and procedures was evident. Unlike Sophia's and Jessica's regular and sustained beginning teacher meetings, Whitney's beginning teacher meetings waned over the course of the school year, while Ingrid's never occurred with any regularity or advanced notice. See Table 16 for a summary of the similarities and differences among participants' school-based induction supports. Table 17 compares the identities-in-practice afforded by and enacted during participants' beginning teacher meetings as well as the meanings they made of those meetings.

Table 16. Summary of Beginning Secondary Science Teachers' School-Based Induction Support

	School-Based Supports		
Participants	Mentor Meetings	Beginning Teacher Meetings	Induction Coordinator
Sophia	• Mentor in licensure area, but outside of discipline (biology rather than earth/ • environmental) • Regularly scheduled meetings	• Originally twice a month, then became weekly • Lasted 30-45 minutes • Sustained throughout school year	• Experienced teacher (career technical education) • Assisted by an assistant principal and another experienced teacher
Ingrid	• Mentor in licensure area • Impromptu meetings	• Monthly • Lasted 1 hour • Sustained throughout school year	• Curriculum facilitator
Jessica	• Mentor out of licensure area (art) • Regularly scheduled meetings	• Infrequent • Little advanced notice • Lasted 5-10 minutes	• Experienced teacher (Spanish) • Positioned herself as liaison between beginning teachers and mentors
Whitney	• Mentor in licensure area, but outside of discipline (chemistry rather than biology) • Scarce meetings	• Infrequent, especially during second semester • Lasted 30-45 minutes • Became part of faculty meetings	• Media center specialist • Worked one-on-one to answer beginning teachers' questions

Note. This information was gleaned from interviews with the beginning secondary science teachers as well as the school personnel who support them.
[a] Considered the mentor's area of licensure compared with the beginning teacher and the nature of the meetings—regularly schedule or irregular, planned or impromptu.
[b] Considered the frequency and length of the beginning teacher meetings and whether they were sustained over the course of the school year.
[c] Considered the position of the induction coordinator on the school's faculty/staff and what I knew to be her role(s), aside from the monthly meeting, in supporting the beginning teachers.

Table 17. Comparison of Identities and Meanings during Beginning Teacher Meetings

Components of Identity Model	Participants			
	Sophia	**Ingrid**	**Jessica**	**Whitney**
Identities Afforded	As developing professional whose needs would change over course of school year; as someone who should be provided support for changing needs	As someone who needed information regardless of hasty presentation; who was not yet a true professional; who it was not a true priority to support in this manner	As someone free to ask questions of and receive feedback from peers; who had valuable ideas and experiences to share with peers; who needed and could give support	As someone who focused on policies and procedures; who needed to be given information; who did not need sustained support into 2nd semester
Identities Enacted	As someone whose needed changed over time; as someone who gained something useful/beneficial from each support	As someone who was skeptical that she could gain anything from the meetings; who was annoyed by the infrequent and last minute nature of the meetings	As someone who asked and answered peers' questions; who had ideas and experiences to share; who was well informed of school schedules, policies, and procedures; who could get similar support elsewhere	As someone who was proactive in getting her questions answered; who did not expect anything specific from the meetings

Table 17 (cont.)

Components of Identity Model	Participants			
	Sophia	**Ingrid**	**Jessica**	**Whitney**
Meanings Made	Meetings with an instructional focus were more beneficial than those focused on procedures; at start of year, appreciated interactions with other beginning teachers	The "get in, get out" beginning teachers meetings were rushed and pointless	Valued procedural support; received support similar to what was gained from mentor, so could do without beginning teacher meetings	Meetings were informative, but not detailed; not well suited to beginning teachers' needs, so sought additional information rather than waiting for topics to be discussed during meetings

With the exception of Whitney, participants identified their mentors as their greatest supports. Despite this commonality, each interacted with her mentor in various ways. Whitney only formally met with her mentor once during the school year; therefore, she drew support more heavily from her colleagues. Though a single meeting with her mentor afforded Whitney beginning science teacher identities-in-practice as someone who did not need regular, continued, and structured support from her mentor, Whitney instead enacted beginning science teacher identities-in-practice that recognized the limitations of her mentor support and positioned her as personally driven to seek the support she needed from her biology colleagues. Both Sophia and Jessica met with their mentors on a weekly basis; however, as Table 18 indicates, the nature of their conversations differed. As discussed in Sophia's case, she positioned herself and was positioned as a colleague during mentor/mentee meetings. She not only received ideas from her mentor, she similarly discussed her own ideas during conversations about instruction. Though conversations with her mentor positioned her more as a colleague than a novice, Sophia nonetheless took up identities-in-practice as a seeker of information: Conversations with her mentor could focus on each of their instructional strategies and concerns, but fundamentally, Sophia attended her mentor/mentee meetings seeking answers or information. Conversely, Jessica positioned herself and was positioned as a new teacher whose mentor checked in with her each week. Most conversations between Jessica and her mentor centered on policies and procedures; those focused on instruction were superficial. See Table 19 for a comparison of the identities-in-practice afforded by and enacted during participants' mentor/mentee meetings as well as the meanings they made of these meetings.

Beginning Teacher Induction as a Priority

As the district's Director of Induction and Professional Development emphasized, the school-based beginning teacher supports were only as strong as the personnel implementing them (interview, 10/21/2010). Though a school's induction coordinator served as the lead mentor at the school, she had other responsibilities as well. Sophia's and Jessica's induction coordinators were also classroom teachers, career technical education and Spanish respectively. Whitney's induction coordinator was also the school's media center specialist and graduation coordinator, and Ingrid's induction coordinator was the school's curriculum facilitator. Though accepting responsibilities to work with mentors and beginning teachers for a small ($500.00) stipend, schools' induction coordinators added the responsibilities that came with this role to the responsibilities already accompanying their primary positions.

Table 18. Topics Discussed during Mentor/Mentee Meetings

Sophia[a]	Ingrid[b]	Jessica[c]	Whitney[d]
• Classroom management • Colleagues • Exams • End-of-year procedures • Instructional issues • Next year • Policies and procedures	• Exams • End-of-year procedures • Instructional issues • Policies and procedures	• Praise from administrator • Exams • End-of-year procedures • Reflection • Instructional issues • Next year • Observations • Policies and procedures • Extra-curricular activities • Monthly beginning teacher meetings	• Praise from administrator • Colleagues • Exams • Instructional issues • Observations

Note. These topics were identified through domain analysis of mentor/mentee meetings as kinds of topics discussed between mentors and mentees. I used the strict inclusion semantic relationship—X is a kind of Y (Spradley, 1980). Though I asked each participant to audio record 3 mentor/mentee meetings, it is worth noting that I did not have equal numbers of audio recording from each participant.
[a] n=1. Sophia reportedly record 3 mentor/mentee meetings, but only gave me 1 recording.
[b] n=3
[c] n=3
[d] n=1
Whitney's audio recording was from her one and only formal mentor/mentee meeting.

Table 19. Comparison of Identities and Meanings during Mentor/Mentee Meetings

Components of Identity Model	**Participants**			
	Sophia	**Ingrid**	**Jessica**	**Whitney**
Identities Afforded	As a colleague; a budding professional	As someone focused on preparing students for EOC exams; who knew standard course of study; who turned to mentor (an expert) with questions	As someone aware of policies and procedures; who needed "checking up on;" who benefited from general support	As someone who did not need regular, continued, and structured support from mentor; who recognized the limits of mentor support; who knew other supports to draw on other than her mentor
Identities Enacted	As a novice who sought information from experienced mentor	As a novice who sought information/answers from her mentor; who was comfortable with transmission model of support	As someone knowledgeable of policies and procedures; who primarily needed help with classroom management	As someone who was personally driven and could be successful without regular mentor support; who was collegial with her mentor and used her mentor as a sounding board for ideas; who recognized the limits of mentor support and sought biology-specific support from her biology colleagues; who was agentic

Table 19 (cont.)

Components of Identity Model	Participants			
	Sophia	**Ingrid**	**Jessica**	**Whitney**
Meanings Made	Greatest support because she could get all of her questions answered	Mentor was source of answers for procedural and instructional questions; provided emotional support	One of most important supports; provided general support that paired well with support from chemistry colleague	Comfortable and confident talking with mentor about her ideas, but, with infrequent meetings and a mismatch of content areas, her mentor was a particularly important support

At times, this meant that induction support for beginning teachers took lower priority than other professional activities and obligations. For example, Whitney attended regularly scheduled monthly beginning teacher meetings during the first semester (final interview, 5/16/2011); however, once second semester started and her induction coordinator became busy with senior projects and graduation, the beginning teacher meetings became more infrequent, to the point that they were no longer separate meetings solely for the school's beginning teachers, but rather were folded into faculty meetings (final interview, 5/16/2011). Jessica, on the other hand, met regularly with the induction coordinator and other beginning teachers at her school, but her professional learning community meetings, which were school-wide with others who shared her planning period, were occasionally canceled for blood drives, field days, and other school events. Similarly, Sophia's weekly beginning teacher meetings were sometimes canceled when an assistant principal, who worked closely with the school's induction coordinator to support the beginning teachers, had meetings or other commitments. Beginning teacher meetings were also canceled for school-wide events, such as student-of-the-month breakfasts. Ingrid's beginning teacher meetings occurred too infrequently and with such short notice, that it was difficult to discern when an intended meeting was canceled due to conflicting priorities.

Impacts on Teaching

The replication- and transmission-model of induction support these beginning secondary science teachers were provided afforded beginning science teacher identities-in-practice centered on getting (rather than giving or co-constructing) information, and knowing and following rules, policies, and procedures. The identities-in-practice they enacted during their induction experiences and classroom science teaching were similarly narrow. Given this, a transmission model was replicated in the beginning secondary science classrooms, with Sophia, Ingrid, and Jessica teaching in teacher-directed ways. Even supports designed to improve science teaching were centered on transmission, with "best practices" and activities being demonstrated for and given to science teachers from across the district. With this example, it was no surprise that Sophia, Ingrid, and Jessica internalized this method in their teaching. Many of their supports (e.g., mentors, PLC, collaborative planning, colleagues, content-focused seminars) had potential to assist with robust, ambitious science teaching; however, none did. This had implications for the science teaching practices these beginning secondary science teachers employed in their classrooms. Common practices included bell ringers, lectures, independent practice, and small group practice. I only rarely observed investigations in Sophia's, Ingrid's, and Jessica's classrooms, and when I did the investigations were cookbook, verification labs.

Whitney was an exception to this. While many of her induction supports afforded beginning science teacher identities-in-practice similarly focused on knowing and following rules, policies, and procedures, she was afforded and enacted broader identities-in-practice centered on both gaining and contributing ideas during her PLCs. She enacted similarly broad identities-in-practice during the district's content-focused seminars. Given this, the identities-in-practice Whitney enacted during her science teaching were not as narrow and teacher-directed as those enacted by other participants. In her induction supports, Whitney sought ideas, activities, and resources that she could adapt to her students and contexts. In doing so, she maintained her vision for successful science teaching concentrated on encouraging her students to see the applicability and relevance of school science content to their everyday lives. Whitney approached all of her induction supports with this lens—seeking opportunities and resources to help her grow as a better teacher (initial interview, 11/8/2010)—and sought experiences and resources to help her teach students about the applicability and relevance of the science they learned. Her classroom science teaching portrayed Whitney's continued focus on application: She wanted her students to not only be able to recall the science content but be able to connect and apply their science knowledge to everyday life.

Summary of Chapter IV

In this chapter, I described the ways in which Sophia, Ingrid, Jessica, and Whitney experienced their induction. Given the state's beginning teacher support policies

(North Carolina State Board of Education, 2010) and purposefully selecting participants from the same school district, I expected the four beginning secondary science teachers to engage in similarly enacted induction experiences; however, my findings highlighted the differences across their experiences. In addition to describing the nature of their induction supports, I discussed the meanings my participants made of their induction experiences. With such an expansive network of support, it was not surprising that the beginning secondary science teachers ascribed value to only a handful of the supports in which they engaged, namely their mentor and colleagues. Next, I discussed the ways in which each participant engaged her induction supports and how such supports influenced her science teaching. I discuss the practical and theoretical implications of these findings in the final chapter.

CHAPTER V

DISCUSSION AND IMPLICATIONS

The Induction and Retention Problem

With issues of staffing the nation's K-12 schools more directly related to teacher retention than teacher recruitment (Cochran-Smith, 2004), factors impacting teacher retention are thrust to the foreground of conversation. One factor impacting teacher retention focuses on the induction supports beginning teachers receive during their first one to three years of teaching. This is a crucial time as "the novice becomes more familiar with their job responsibilities, the work setting, and professional norms and expectations" (Bartell, 2005, p. 5). According to Julie Luft (2003, 2007), the learning and development of beginning science teachers during this time is often underexplored. She maintains that developing a more informed understanding of beginning science teachers' experiences during their induction will provide a more thorough view of science teachers' continuous development across their careers (Luft, 2003, 2007).

While research shows that beginning science teachers benefit from induction programs (Ingersoll, 2006; Luft et al., 2007; Luft & Patterson, 2002; Luft et al., 2003; Patterson et al., 2003; Roehrig & Luft, 2006), little is known about the nature of beginning science teachers' induction supports or the ways in which beginning science teachers experience these supports. This multi-case study examined the ways in which beginning secondary science teachers experienced induction, the meanings they made of their induction experiences, and the identities-in-practice afforded to them as well as those they enacted during their induction experiences and classroom science teaching to further develop an understanding of the supports beginning secondary science teachers find valuable and how they draw on these supports during their first year of teaching.

My study was designed to explore the nature of beginning secondary science teachers' induction supports. That is, how do beginning secondary science teachers experience induction and what meaning do they ascribe to their induction experiences? Additionally, who are we expecting beginning secondary science teachers to be (afforded identities-in-practice) and who are they (enacted identities-in-practice) during their first year of teaching? The findings from this study answer these questions for the individual teachers and contexts I studied. Were the beginning secondary science teachers supported? Yes, in an overwhelming number of ways—overwhelming because of all the supports and experiences in which the beginning secondary science teachers engaged, they typically only ascribed meaning or value to a few. Next, I summarize my findings, and then discuss practical and theoretical implications of this study.

A Smorgasbord of Support

The primary research questions and sub-questions that guided this study were

Primary Research Question #1:

How do beginning secondary science teachers experience induction?

Sub-questions:

a. What meanings do beginning secondary science teachers make of their induction experiences?

b. What meanings of “science teacher” are implied by their induction experiences? In other words, what are the identify affordances of their induction experiences and supports?

c. What identities-in-practice do beginning secondary science teachers enact during their induction experiences?

Primary Research Question #2:

What identities-in-practice do beginning secondary science teachers enact during their classroom science teaching?

A major finding of this study was that my participants were involved in numerous induction experiences, yet only discussed a select few as important or impactful. Sophia, Ingrid, Jessica, and Whitney had access to and engaged in numerous induction supports: district orientation, induction and success coaches, mentors, beginning teacher meetings, colleagues, professional learning communities, collaborative planning, administrators, students, district content-focused seminars, district online instruction resources, and additional professional development. Despite the length of this list, only three supports were consistently discussed as the most important: mentors, colleagues, and professional learning communities. This finding emphasized a mismatch between the supports my participants were provided and the supports they felt they needed.

Perhaps a symptom of the numerous supports provided to beginning teachers in the district, a subsequent finding revealed that while each participant was given access to same-named supports, the purpose and nature of these supports varied from school to school. For example, though in the same district, Jessica’s school implemented PLCs in fundamentally different ways than did Whitney's school. Jessica's PLC was school-wide and primarily focused on cooperative learning strategies, while Whitney's PLC was discipline-specific and primarily focused on analyzing common assessment data to discuss best practices and ensure student learning. Similarly, beginning teacher meetings were implemented differently in each school, from Sophia, who had weekly beginning teacher meetings, to Whitney, whose beginning teacher meetings waned in the second semester, to Ingrid, who had infrequent beginning teacher meetings with little advanced notice. Mentor/mentee meetings were also conducted differently in various contexts.

With this "smorgasbord" of supports—beginning teachers in this study attended orientation, beginning teacher meetings, PLCs, and content-focused seminars; and were assigned an induction and success coach, and mentor—beginning teachers were able to access supports within their networks to address particular needs. However, participants consistently discussed mentors, colleagues, and content-focused seminars as their most valuable supports. Although findings from this qualitative multi-case study and other large-scale, quantitative studies demonstrated that mentoring and induction programs vary greatly across contexts (Smith & Ingersoll, 2004; Villani 2002), the core components of such programs were well agreed upon in the teacher induction literature. According to the literature, beginning teachers should be afforded the opportunity to interact and engage with a mentor, who was carefully selected (Bartell, 2005; Britton et al., 2000; Darling-Hammond & Baratz-Snowden, 2005; Villani, 2002), trained and well supported (Berry et al., 2002; Britton et al., 2000; Darling-Hammond & Baratz-Snowden, 2005; Moir, 2005; Villani, 2002), and purposefully paired with beginning teachers

(Bartell, 2005; Johnson & The Project on the Next Generation of Teachers, 2004). Wang and Odell (2002) maintained that mentoring should center on improving teaching quality by focusing on standards and engaging beginning teachers in examining their beliefs and practices. In addition to mentoring, administrative support focused on the goals of induction and those who assist and mentor new teachers (Bartell, 2005) was necessary to successfully induct and retain beginning teachers.

Though we have a list of effective induction supports from the literature, when such ideas and practices are put together in various contexts with the goal of supporting beginning teachers, little is known about how beginning teachers experience and make meaning of all these supports. Exploration of afforded and enacted identities-in-practice and meaning making of Sophia, Ingrid, Jessica, and Whitney during their induction supports revealed that a “smorgasbord” of support had unintended consequences related to who beginning science teachers are asked to be. Many of the supports, while well-intentioned, were places or people for the beginning secondary science teachers to turn to for help. This notion afforded beginning science teacher identities-in-practice centered on a top-down transmission model of support and implied that beginning science teachers were unaware of the supports they actually needed. That is, in being provided with so much information and so many places to turn for information, answers, and solutions, participants’ induction supports took for granted that they did not know what they needed during their first year of teaching: The schools and district knew what beginning teachers needed (which was a lot!), and therefore provided it to them in a top-down manner.

While they participated in each provided support to varying degrees of engagement, Sophia, Ingrid, Jessica, and Whitney did not question the district's and schools' expectations for their participation. Only Whitney mentioned that her network of support was "overwhelming;" however, she did not say this with a negative connotation. Rather, she felt "there's so many directions I could turn in need of, okay I don't know what to do. So, I never feel like a problem's gonna go unanswered because I can shoot one email in six different directions and get six different options back" (initial interview, 11/8/2010). Unlike other participants who attended their induction supports because they were expected to and enacted beginning science teacher identities-in-practice focused on transmission of information and ideas from their support to themselves in response to questions or problems, this "smorgasbord" of support took on a different meaning for Whitney. As previously discussed in Chapter IV, Whitney's induction supports and experiences afforded beginning science teacher identities-in-practice as someone who was confident and agentic; Whitney took up these identities-in-practice during her induction experiences and in her classroom science teaching. She positioned herself as a budding professional, willing and able to get help when she needed it. Rather than being overwhelmed and bogged down by the numerous supports provided her, Whitney consistently performed herself as someone who could learn from all of her experiences, someone with room to grow yet with valuable expertise to contribute to her PLC, department, school, and district. She approached each of her induction supports wanting opportunities and resources to "grow as a better teacher" (initial interview, 11/8/2010). This approach and the identities-in-practice Whitney enacted were in stark contrast to the beginning science teacher identities-in-practice as someone seeking answers and solutions typically enacted by other participants.

The Value of Flexible, Agentic Supports

Though Ingersoll (2006) and Smith and Ingersoll (2004) demonstrated in large-scale studies that teacher turnover rates were reduced from 41% to 27% for teachers participating in some induction activities, including subject-like mentoring, common planning, face time with school administrators, and beginning teacher seminars, as compared to those receiving no induction, in planning such expansive support programs do districts and schools take for granted that beginning teachers are unaware of what they need? Are induction support providers reducing beginning teachers' agency and removing opportunities for them to tailor their induction supports to suit their personal needs by mandating overwhelming numbers of induction activities?

My findings revealed that participants valued flexible and agentic supports focused on instruction. That is, rather than finding supports focused on policies and procedures to be most beneficial and important, Sophia, Ingrid, Jessica, and Whitney most valued context-specific, more instructionally focused support. Their mentors, colleagues, and PLC meetings were school-based supports that could be accessed as needed and featured flexibility to tailor these supports to meet specific and timely needs. Although Ingrid, Jessica, and to some extent Sophia, enacted transmission-focused beginning science teacher identities-in-practice while engaging these contextual supports, their mentors, colleagues, and PLCs nonetheless provided support for a wide range of topics, issues, and assistance that the beginning secondary science teachers chose for themselves. Unlike during beginning teacher meetings and content-focused seminars, Sophia, Ingrid, Jessica, and Whitney had more agency over the topics discussed with their mentors, colleagues, and PLCs.[27]

“Learning as Becoming” a High School Science Teacher

Attracted to the notion of “learning as becoming” (Wenger, 1998, p. 5) as a metaphor for the process of growing, developing, and forming an identity as a high school science teacher, I originally chose to conceptualize identity according to Wenger’s (1998) modes of belong: engagement, imagination, and alignment. In analyzing my data, however, I realized that Wenger’s modes of belonging were inappropriate to conceptualize and discuss the identity development of my participations during their first year of teaching: From the start, my participants were held accountable for being full-functioning members of their communities of practice; therefore, the engagement, imagination, and alignment work as they “became” teachers was not evident in the stories they told. As seen in Table 20, I thought about the ways in which I would recognize the modes of belonging in my data. Nevertheless, I recognized that my participants’ experiences and actions did not neatly fit within one of these modes. For example, I frequently came across a blur of imagination and alignment in participants’ struggles with negotiating who they wanted to be and who they were expected to be in a particular context.

[27] Jessica’s school-wide PLC meetings were an exception to this finding; however, her collaborative planning meetings frequently served in the same support capacity as other’s PLC meetings.

Table 20. Ideas for Recognizing Wenger's Modes of Belonging in My Data

Wenger's mode of belonging	Ways to recognize in data
Engagement	• Participation in induction activities • Engagement with colleagues (during PLC and content-focused seminar), mentors, and students
Imagination	• Vision of self as science teacher • Vision of successful science teacher • Future self • Locating/positioning self in what it means to be a science teacher
Alignment	• Sources of meanings of successful science teaching • Evidence of influence of department, school, district on teaching

Wenger's (1998) modes of belonging, while initially useful in conceptualizing beginning secondary science teachers' identities-in-practice, did not help to explain the experiences and actions of the beginning secondary science teachers as they enacted their identities-in-practice. Their identity work seemed to exist in overlaps between Wenger's modes of belonging. Though others have studied beginning teachers' identities using this framework (Grier & Johnston, 2009; Williams, 2010), I believe an identity framework that considers meaning making as well as enacted identities is necessary for studying the complexity of beginning secondary science teachers' identities-in-practice.

An Analytic Model of Identities-in-Practice and Meaning Making

Many of the studies that applied Wenger's (1998) modes of belonging to examine science teacher identities focused on the experiences of career changers during teacher preparation programs and student teaching (Grier & Johnston, 2009; Williams, 2010). In her study of a career changer's experiences in these contexts, Judy Williams (2010) focused on the brokering experiences of one career changer, Michelle, describing her as an "expert novice" who experienced "tensions and at times dissonance between [her] identities as 'old-timers' (experts) in other communities of practice and as 'newcomers' (novices) in teacher education (p. 642). Brokering, which Williams (2010) focused on in Michelle's experiences, entailed using "multimembership to transfer some element of one practice into another" (Wenger, 1998, p. 109). Brokering and reconciliation of different forms of community membership were evident in Michelle's experiences of learning to become a teacher and taking on the role of "expert novice": Her experiences in previous careers as a hair dresser and human resources manager impacted her perceptions of herself as a primary grades English teacher. Overall, Michelle's teacher education and student teaching experiences "enabled her to negotiate new meanings about learning and teaching," with her identity as "expert notice" being an essential part of this negotiation (Williams, 2010, p. 646). Drawing on her theoretical framework, Williams (2010) concluded "that a central element in understanding the process of learning and identity construction of career change students is the concept of reconciling their different identities and promoting the inclusion of already existing skills and experiences in their learning to be a teacher" (p. 646).

In a study of the teacher identities of STEM career changers, Jeanne Grier and Carol Johnston (2009) used Wenger's (1998) modes of belonging to conceptualize teacher identity as "based upon the core beliefs one has about teaching and being a teacher that are constantly changing and evolving based upon personal and professional experiences" (Grier & Johnston, 2009, p. 59). Similar to Williams' (2010) discussion, Grier and Johnston (2009) highlighted that the STEM career changers they studied had to make sense of their new roles as math and science teachers: They "were learning not only how to negotiate their introduction into the teaching profession but also renegotiating their roles as adult students" (p. 67).

Unlike the career changers Grier and Johnston (2009) and Williams (2010) studied, the participants in this study, while new to their particular schools and teaching classes solely on their own, were not unfamiliar with or new to teaching high school science in the state. Each successfully completed student teaching the semester prior to accepting their first teaching job. With backgrounds and preparation in high school science teaching, their initial positionalities at the start of the school year were qualitatively different from the experiences of the career changers Grier and Johnston (2009) and Williams (2010) studied. As more fully functioning members of their communities of practice at the time this study began, Sophia, Ingrid, Jessica, and Whitney were no longer telling stories that could be appropriately analyzed using a framework centered on engagement, imagination, and alignment (Wenger, 1998).

Considering that same-named induction supports were frequently differentially enacted across contexts (e.g., beginning teacher meetings and PCL) and that participants made drastically different meanings of the exact same support (e.g., content-focused seminars), I sought an identity framework that enabled me to make sense of these discrepancies while still focusing on the interplay between meaning-making and identity. For this analytic model, I drew on Cobb et al.'s (2009) concept of normative identity. See

Figure 3 for a description of the interplay between components in the model I used to analyze identities-in-practice and meaning making.

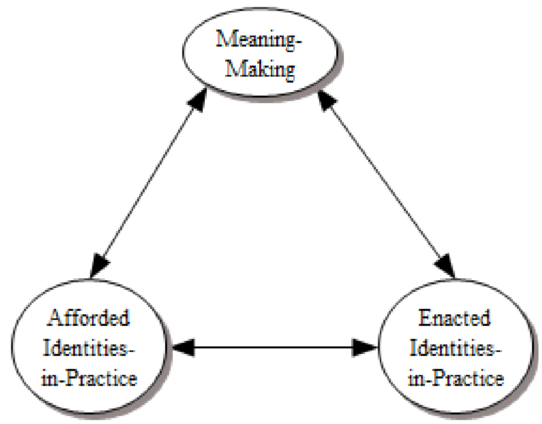

Figure 3. Analytic Model of Afforded Identities-in-Practice, Enacted Identities-in-Practice, and Meaning Making

I considered normative identity to be the promoted ways of being a beginning science teacher within the contexts of induction supports and classroom science teaching. This accounted for the identities-in-practice afforded by various supports and contexts. Afforded identities-in-practice considered alongside the identities-in-practice my participants took up and enacted during their induction supports and science teaching enabled me to more fully understand their meaning making beyond yes they did—or no, they did not—like or value particular supports, teaching activities, lessons, etc. This model enabled me to better understand the induction experiences, identities-in-practice, and meaning making of Sophia, Ingrid, Jessica, and Whitney across the various contexts in which they participated.

From Induction Hodge-Podge to Induction Intentionality

Despite the finding that these beginning secondary science teachers were afforded and subsequently enacted (with the exception of Whitney) beginning science teacher identities-in-practice focused on transmission of information (e.g., from their induction supports to themselves; from themselves to their students), the district has moved in the direction of providing increased support to beginning teachers. Over the course of nine years, they shifted from providing district orientation and a mentor to giving beginning teachers a vast network of mostly school-based supports. An increased focus on supporting science teachers from across the district regardless of their years of experience accompanied this shift from large-scale (district orientation) to more school-based supports (beginning teacher meetings, PLC, collaborative planning). The meanings my participants made of their supports as well as the identities-in-practice they enacted during their induction experiences and classroom science teaching point to opportunities to further improve beginning science teachers' induction experiences. Below, I recommend design principles for induction that emerged from this study as well as the limitations and implications of this research.

Induction Design Principles

While I do not think making specific policy recommendations based on the findings from these four qualitative case studies is appropriate, important design principles for the induction of beginning secondary science teachers emerged from the analysis of Sophia's, Ingrid's, Jessica's, and Whitney's stories and experiences. These design principles, outlined below, are intentionally broad: broad enough to apply to diverse school contexts, but not so specific that the design principles cannot emerge differently within these contexts.

Design recommendations. Based on the findings of this multi-case study, I propose three overarching design principles that include (a) responsiveness to context, (b) promotion of analysis of and reflection on quality science teaching, and (c) awareness of who we ask beginning science teachers to be (afforded identities-in-practice).

Responsiveness to context. The findings of this study pointed to the importance of induction supports that were responsive to the contexts in which beginning secondary science teachers teach. While all four beginning secondary science teachers were expected to receive the same types of induction supports because they taught in the same school district, the implementation of these supports varied from school to school, as the supports were frequently modified and altered to suit the needs and agendas of each individual school and administration. Though differential implementation was a consequence of decentralizing the induction support provided beginning teachers, responsiveness to school-based contexts is imperative for the successful support and retention of beginning teachers. As Johnson & The Project on the Next Generation of Teachers (2004) established,

> a carefully tailored, comprehensive induction program is essential if new teachers are to teach their classes successfully, work interdependently with their colleagues, and meet a shared commitment to schoolwide learning. Without school-based induction, how would new teachers know what the school expects of them and how they can best do their jobs? (p. 194)

Since Sophia, Ingrid, Jessica, and Whitney taught in very distinct contexts (e.g., science department and school), each with unique and specific expectations (i.e., afforded identities) and cultures, it is naïve to believe that strictly implemented and uniform supports would be most supportive to each of these four beginning secondary science teachers in their specific contexts. In fact, Sophia, Ingrid, Jessica, and Whitney most readily accessed and valued supports most responsive to their contexts (e.g., mentors, colleagues, and PLCs). When applicability and relevance to their specific contexts were not discernible, these beginning secondary science teachers were generally uninterested in finding connections to their own science teaching and contexts (e.g., Jessica's skepticism during content-focused seminars that she could use any of the ideas or activities without first modifying them). Since normative (afforded) beginning teacher and beginning science teacher identities vary from context to context (and situation to situation within those contexts), the supports provided to beginning secondary science teachers should serve to foster robust science teacher identities and support ambitious science teaching within their particular contexts. How this is accomplished and what it looks like in practice necessarily varies within and across contexts; therefore, the induction supports provided beginning secondary science teachers should be responsive to the contexts in which they teach.

Promotion of analysis and reflection on teaching. During context-responsive supports, beginning secondary science teachers should also receive science-focused induction supports. As Britton, Raizen, Paine, and Huntley (2000) highlighted, effective induction programs should assist beginning teachers in subject-specific issues related to curriculum and instruction, stating that “while teachers need to command general teaching skills, they also need specific knowledge of how to help students learn different subject” (p. 4). While these case studies, as well as other research, established a need for science-focused support (Luft, 2009; Luft & Patterson, 2002; Luft et al., 2003; Roehrig & Luft, 2006), such support should focus on fostering ambitious science teaching that enables all students to understand science, participate in the discourses of science, and solve authentic science problems (Windschitl, Thompson, & Braaten, 2011). The high-leverage teaching practices associated with ambitious science teaching include identifying big, worthy science ideas; eliciting students’ understandings of these ideas; helping students make sense of science activities; and pressing students for evidence-based explanations (Windschitl, Thompson, & Braaten, 2011). Fostering ambitious science teaching through the use of high-leverage practices by beginning secondary science teachers can only happen if and when aspects of induction support are purposefully science-focused and aimed at promoting critical analysis of and reflection on science teaching (see Windschitl, Thompson, & Braaten, 2011 for a discussion of using critical friends groups to accomplish this).

Vital aspects of science-focused induction support that can promote critical analysis of and reflection on ambitious science teaching are science coaches. The term “coach” is frequently used in descriptions of induction programs and supports (Villani, 2002) to describe former science teachers who simply have more years of experience than the teachers they support. While coaches are important in supporting instructional improvement and development of high-leverage practices within a school or district, coaches should not only be more experienced than the teachers they support, they need to be more experienced with and knowledgeable about the teaching practices we aim for them to foster and support. That is, science coaches should be experienced with and knowledgeable about ambitious science teaching and high-leverage practices. Both of these and beginning secondary science teachers' use of them are vital for a science education that is accessible to all students and encourages students' scientific literacy. Much of the supports provided to Sophia, Ingrid, Jessica, and Whitney were administrative in intent and focus, centered primarily on rules, policies, and procedures; few supports were instructionally focused. That is, they provided limited time and space for these beginning secondary science teachers to think about and develop ambitious science teaching. A more-knowledgeable coach with experience using high-leverage practices to teach science in ambitious ways is central to ensuring that science-focused support is truly instructional in nature.

Awareness of afforded identities. In providing context-responsive, science-focused supports to beginning secondary science teachers, we need to be mindful of who we are expecting beginning science teachers to be (afforded identities). If, for example, we structure induction supports according to a transmission model and afford beginning science teacher identities-in-practice centered on getting information and knowing and following rules and procedures, not only are these more than like the identities our beginning secondary science teachers will enact, but they likewise have implications for their science teaching practices. That is, when we do not take into consideration what beginning secondary science teachers bring to their induction supports and we instead ask them to simply get information from their induction supports (science-focused and general), then they are more likely to regurgitate information and content in their teaching. Conversely, if we ask them (and afford them opportunities to) think of big ideas and evidence-based explanations relevant to their discipline, then we will be more likely to see these elements in their science teaching—*if* this ambitious teaching is what science-focused supports, including coaches, foster and support. Awareness of who we expect beginning secondary science teachers to be (afforded identities) iterative with who they become (enacted identities) enables us to understand the meanings they make of their experiences. Their meanings have implications for their development and science teaching since we act toward things based on the meanings they hold (Carlone, personal communication, March 26, 2012)

Induction practices of the district. While I advocate context-responsive, science-focused design principles for induction that attend to *who* we expect beginning science teachers to be and foster them to become, the district in which Sophia, Ingrid, Jessica, and Whitney taught relied primarily on a transmission model of induction for beginning teachers in general and beginning science teachers specifically. As previously discussed, the district has shifted from a large-scale, centrally-focused induction model that relied primarily on district orientation and mentors to support beginning teachers to a school-based model in which beginning teachers attend district orientation and are assigned school-based mentor plus participate in beginning teacher meetings, PLCs, collaborative planning, and content-focused seminars.

With 11% of the district's teachers having zero to three years of experience,[28] and thus receiving support through the Department of Induction and Professional Development during the 2010-2011 school year, the Director of Induction and Professional Development and the induction and success coaches who work with her undoubtedly work with and support large numbers of beginning teachers. Though the district has moved to school-based, discipline-focused induction support, the design elements I described above were inherently missing. This could be due to the large number of beginning teachers the district supports. Of the beginning teachers during the 2010-2011 school year, only 15 were beginning secondary science teacher, a rather small number compared with all the new teachers across grade levels and subjects. While the district's science curriculum specialist was making efforts toward more inquiry-based science teaching with the monthly content-focused seminars, a focus on fostering and supporting ambitious science teaching and high-leverage practices was nonetheless absent and teachers of state-tested subjects received more support than those who teach non-tested subjects. The design principles I proposed above could, thus, be used to further develop the induction supports beginning secondary science teachers in the district receive.

Limitations and Implications

As a qualitative, multi-case study, the findings of this study are not generalizable to the induction experiences, identities-in-practice, and meaning making of beginning secondary science teachers in other districts or states. Despite lacking external

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[28] http://www.ncreportcards.org/src/distDetails.jsp?Page=4&pSchCode=484&pLEACode=410&pYear=2010-2011&pDataType=1

generalizability, these findings are internally generalizable within the setting (school district) and group (beginning secondary science teachers) being studied (Maxwell, 2005). Given this, an interesting area for future study would be to see whether and in what ways the design principles that emerged from this study are applicable to the induction experiences of beginning secondary science teachers in other districts and states. For example, since induction inherently differs by context, a future study could explore the applicability of the design principles I proposed above to the induction of beginning secondary science teachers in Louisiana. That is, how do beginning secondary science teachers in Louisiana experiences their induction? What are their afforded identities, enacted identities, and meanings during their induction supports? Once the context is understood, I could explore whether similar design principles for induction emerge? Similarly, I could apply the design principles that emerged from this study to the induction support provided to beginning secondary science teachers in a specific parish or those graduating from a specific licensure program.

Concluding Remarks

Expecting to find that my participants felt well supported by their vast support networks—support networks I originally wished I had access to as a beginning science teacher—I was initially surprised that the beginning secondary science teachers in my study did not register more of their supports as important and supportive. And then as I analyzed my data and reflected on my findings, I was discouraged that planning and implementing "best practices" of teacher support and induction would not be enough to encourage and foster beginning science teachers to be the types of science teachers science educators and science education researchers know our students need and deserve—teachers who employ ambitious teaching practices (Windschitl et al., 2011) to teach in inquiry-based ways (NRC, 1996). Once I considered the demands placed on beginning teachers, I began to question whether all of the supports were necessary, and if not, which ones should be given priority. For me, this called into question whether we should consider alternative ways to think about the quality of induction supports we provide beginning secondary science teachers; that is, to focus on who we ask beginning secondary science teachers to be through the induction supports we provide, rather than focusing solely on whether teachers are retained. Instinctively, I thought offering science-focused induction (Luft et al., 2007; Luft & Patterson, 2002; Luft et al., 2003; Roehrig & Luft, 2006) would be a key response to this dilemma. Research by Luft and her colleagues (Luft, 2009; Luft, Firestone, Weeks, Wong, Adams, & Ortega, 2012; Luft, Firestone, Wong, Ortega, Adams, & Bang, 2011; Luft et al., 2007; Luft & Patterson, 2002; Luft et al., 2003; Roehrig & Luft, 2006) demonstrated that beginning secondary science teachers benefitted from science-focused induction programs: From their participation in science-focused induction, their beliefs about science teaching, pedagogical content knowledge, and science teaching practices were strengthened. Furthermore, beginning secondary science teachers who participated in science-focused induction incorporated more investigations and inquiry-based laboratory activities into their teaching than did teachers in other induction programs. While promising, Luft and colleagues (2012) concluded at the end of their five-year longitudinal study that, while beginning secondary science teachers were initially positively impacted by and gained from science-focused induction programs, over time they were more heavily influenced by their school cultures than their science-focused induction supports, coming to teach in ways similar to those beginning secondary science teachers who had not participated in science-focused induction programs. These findings, as well as those of my dissertation study, serve to reinforce that the induction of beginning secondary science teachers is important work and that research on the successful induction of beginning secondary science teachers is merited.

REFERENCES

Alsup, J. (2006). *Teacher identity discourses: Negotiating personal and professional spaces.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

American Association for the Advancement of Science. (1993). *Benchmarks for science literacy*. New York: Oxford University Press.

Bartell, A.C. (2005). *Cultivating high-quality teaching through induction and mentoring.* Thousand Oaks, CA: Corwin Press.

Berliner, D. (2001). Learning about and from expert teachers. *International Journal of Educational Research, 35*(5), 463-482.

Berry, B., Hopkins-Thompson, T., & Hoke, M. (2002). *Assessing and supporting new teachers: Lessons from the Southeast.* North Carolina: The Southeast Center for Teaching Quality at the University of North Carolina.

Bickmore, D. L., & Bickmore, S. T. (2010). A multifaceted approach to teacher induction. *Teaching and Teacher Education, 26*(4), 1006–1014.

Britton, E., Raizen, S., Paine, L., & Huntley, M. A. (2000). More swimming, less sinking: Perspectives on teacher induction in the U.S. and abroad. National Commission of Teaching Mathematics and Science in the 21st Century.

Carlone, H. B., Haun-Frank, J., & Webb, A. (2011). Assessing equity beyond knowledge- and skills-based outcomes: A comparative ethnography of two fourth-grade reform-based science classrooms. *Journal of Research in Science Teaching, 48,* 459–485.

Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching, 44,* 1187–1218.

Chapman, D. W. (1983). A model of the influences on teacher retention. *Journal of Teacher Education, 34*(5), 43–49.

Chapman, D. W. (1984). Teacher retention: The test of a model. *American Educational Research Journal, 21*(3), 645–658.

Chapman, D. W., & Green, M. S. (1986). Teacher retention: A further examination. *Journal of Educational Research, 79*(5), 273–279.

Claxton, G. (2002). Education for the learning age: A sociocultrual approach to learning to learn. In G. Wells & G. Claxton (Eds.), *Learning for life in the 21st century: Sociocultural perspectives on the future of education* (pp. 21–33). Malden, MA: Blackwell.

Cobb, P., Gresalfi, M., & Hodge, L. L. (2009). An interpretive scheme for analyzing the identities that students develop in mathematics classrooms. *Journal for Research in Mathematics Education, 40,* 40–68.

Cochran-Smith, M. (2004). Stayers, leavers, lovers, and dreamers: Insights about teacher retention. *Journal of Teacher Education, 55*(5), 387–392.

Cochran-Smith, M., & Lytle, S. (1999). Relationships of knowledge and practice: Teacher learning in communities. *Review of Research in Education, 24,* 249–305.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed). Thousand Oaks, CA: Sage.

Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (2nd ed). Upper Saddle River, NJ: Pearson Education.

Darling-Hammond, L., & Baratz-Snowden. (Eds.). (2005). *A good teacher in every classroom*. San Francisco, CA: Jossey-Bass.

Darling-Hammond, L., & Sato, M. (2006). Keeping good science teachers: What science leaders can do. In J. Rhoton & P. Shane (Eds.), *Teaching science in the 21st century* (pp. 177–196). Arlington, VA: NSTA Press.

Davis, E. A., Petish, D., & Smithey, J. (2006). Challenges new science teachers face. *Review of Educational Research, 76*(4), 607–651.

DuFour, R. (2004). What is a "professional learning community"? *Educational Leadership, 61*(8), 6–11.

Eisenhardt, K. M. (2002). Building theories from case study research. In A. M. Huberman & M. B. Miles (Eds.), *The qualitative researcher's companion* (pp. 5–35). Thousand Oaks, CA: Sage.

Elster, D. (2009). Biology in context: Teachers' professional development in learning communities. *Journal of Biology Education, 43*(2), 53–61.

Fuller, F. F. (1969). Concerns of teachers: A developmental conceptualization. *American Educational Research Journal, 6*(2), 207–226.

Gee, J. P. (2000-2001). Identity as an analytic lens for research in education. *Review of Research in Education, 25,* 99–125.

Gold, Y. (1996). Beginning teacher support: Attrition, mentoring, and induction. In J. Sikula, T. J. Buttery, & E. Guyton (Eds.), *Handbook of research on teacher education* (pp. 548–594). New York, NY: Simon & Schuster Macmillan.

Greeno, J. G. (1998). The situativity of knowing, learning, and research. *American Psychologist, 53*(1), 5–26.

Grier, J. M., & Johnston, C. C. (2009). An inquiry into the development of teacher identities in STEM career changers. *Journal of Science Teacher Education, 20,* 57–75.

Hammerness, K., Darling-Hammond, L., Bransford, J., Berliner, D., Cochran-Smith, M., McDonald, M., & Zeichner, K. (2005). How teachers learn and develop. In L. Darling Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world: What teachers should learn and be able to do* (pp. 358–389). San Francisco, CA: Jossey-Bass.

Heilbronn, R. (2004). From trainee to newly qualified teacher: Your immediate professional needs. In S. Capel, R. Heilbronn, M. Leask, & T. Turner (Eds.), *Starting to Teach in Secondary School: A Companion for Newly Qualified Teachers* (pp. 3–15). New York, NY: Routledge Falmer.

Holland, D., Lachicotte Jr., W., Skinner, D., & Cain, C. (1998). *Identity and agency in cultured worlds.* Cambridge, MA: Harvard University Press.

Ingersoll, R. (2001). Teacher turnover and teacher shortages: An organizational analysis. *American Educational Research Journal, 38*(3), 499–534.

Ingersoll, R. M. (2003). Turnover and shortages among science and mathematics teachers in the United States. In J. Rhoton & P. Bowers (Eds.), *Science teacher retention: Mentoring and renewal* (pp. 1–12). Arlington, VA: NSTA Press.

Ingersoll, R. M. (2006). Understanding supply and demand among mathematics and science teachers. In J. Rhoton & P. Shane (Eds.), *Teaching science in the 21st century* (pp. 197–211). Arlington, VA: NSTA Press.

Johnson, S. M., Berg, J. H., & Donaldson, M. L. (2005). *Who stays in teaching and why: A review of literature on teacher retention.* Washington DC: NRTA, AARP's Educator Community.

Johnson, S. M., & The Project on the Next Generation of Teachers. (2004). *Finders and keepers: Helping new teachers survive and thrive in our schools*. San Francisco, CA: Jossey Bass.

Kardos, S. M., & Johnson, S. M. (2007). On their own and presumed expert: New teachers' experience with their colleagues. *Teachers College Record, 109*(9), 2083–2106.

Keller, B. (2003, January 9). The job-seekers. *Education Week, 22*(17), 41–44.

Krajcik, J. S., Czerniak, C., & Berger, C. (2002). *Teaching science in elementary and middle school classrooms: A project-based approach* (2nd ed). Boston, MA: McGraw-Hill.

Lakshmanan, A., Heath, B. P., Perlmutter, A., & Elder, M. (2011). The impact of science content and professional learning communities on science teaching efficacy and standards-based instruction. *Journal of Research in Science Teaching, 48*(5), 534–551. doi:10.1002/tea.20404

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* New York, NY: Cambridge University Press.

Luehmann, A. L. (2007). Identity development as a lens to science teacher preparation. *Science Education, 91*(5), 822–839.

Levin, B. B. (2003). *Case studies of teacher development: An in-depth look at how thinking about pedagogy develop over time.* Mahwah, NJ: Lawrence Erlbaum.

Liou, P-Y., Kirchhoff, A., & Lawrenz, F. (2010). Perceived effects of scholarships on STEM majors' commitment to teaching in high need schools. *Journal of Science Teacher Education, 21,* 451–470.

Liou, P-Y., & Lawrenz, F. (2011). Optimizing teacher preparation loan forgiveness programs: Variables related to perceived influence. *Science Education, 95*(1), 121–144.

Little, J. W. (2003). Inside teacher community: Representations of classroom practice. *Teachers College Record, 105*(6), 913–945.

Luft, J. A. (2003). Induction programs for science teachers: What the research says. In J. Rhoton & P. Bowers (Eds.), *Science teacher retention: Mentoring and renewal* (pp. 35–44). Arlington, VA: NSTA Press.

Luft, J. A. (2007). Minding the gap: Needed research on beginning/newly qualified science teachers. *Journal of Research in Science Teaching, 44*(4), 532–537.

Luft, J. A. (2009). Beginning secondary science teachers in different induction programmes: The first year of teaching. *International Journal of Science Education, 31,* 2355–2384.

Luft, J. A., Firestone, J. B., Weeks, C. B., Wong, S. S., Adams, K., & Ortega, I. B. (2012).*Beginning secondary science teachers' beliefs, practices, and experiences: A five-year mixed methods study.* Paper presented at the 85th National Association for Research in Science Teaching Annual International Conference, Indianapolis, IN. Abstract retrieved from https://www.narst.org/annualconference/2012_full_abstracts.pdf

Luft, J. A., Firestone, J. B., Wong, S. S., Ortega, I., Adams, K., & Band E. J. (2011). Beginning secondary science teacher induction: A two-year mixed methods study. *Journal of Research in Science Teaching, 48,* 1199–1224.

Luft, J. A., Lee, E., Fletcher, S., & Roehrig, G. (2007). Growing or wilting? Beginning biology teachers in an induction program for science teachers. *The American Biology Teacher, 69*(6), 341–346.

Luft, J. A., & Patterson, N. C. (2002). Bridging the gap: Supporting beginning science teachers. *Journal of Science Teacher Education, 13*(4), 267–282.

Luft, J. A., Roehrig, G. H., & Patterson, N. C. (2003). Contrasting landscapes: A comparison of the impact of different induction programs on beginning secondary science teachers' practices, beliefs, and experiences. *Journal of Research in Science Teaching, 40*(1), 77–97.

Marvel, J., Lyter, D. M., Peltoal, P., Strizek, G. A., Morton, B. A., & Rowland, R. (2007). *Teacher attrition and mobility: Results from the 2004-05 teacher follow-up survey.* National Center for Education Statistics.

Maxwell, J. A. (2002). Understanding and validity in qualitative research. In A. M. Huberman & M. B. Miles (Eds.), *The qualitative researcher's companion* (pp. 37–64). Thousand Oaks, CA: Sage.

Maxwell, J. A. (2005). *Qualitative research design: An interactive approach* (2nd ed.). Thousand Oaks, CA: Sage.

Merriam, S. B. (2001). *Qualitative research and case study applications in education.* San Francisco, CA: Jossey-Bass.

Merriam, S. B. (2002). Assessing and evaluating qualitative research. In S. B. Merriam (Ed.), *Qualitative research in practice: Examples for discussion and analysis* (pp. 18–33). San Francisco, CA: Jossey Bass.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage.

Moir, E. (2005). Launching the next generation of teachers: The New Teacher Center's model for quality induction and mentoring. In H. Portner (Ed.), *Teacher mentoring and induction: The state of the art and beyond* (pp. 59–73). Thousand Oaks, CA: Corwin Press.

National Commission on Teaching and America's Future & NCTAF State Partners. (2002, August). *Unraveling the "teacher shortage" problem: Teacher retention is the key.* Symposium of the National Commission on Teaching and America's Future and NCTAF State Partners.

National Research Council. (1996). *National science education standards*. Washington, DC: Author.

National Science Foundation. (2008). *Robert Noyce Teacher Scholarship Program*. Retrieved March 22, 2011, from http://www.nsf.gov/pubs/2008/nsf08532/nsf08532.txt

North Carolina Professional Teaching Standards Commission. (2008). *North Carolina professional teaching standards.* Retrieved from http://www.ncpts.org/Final%20Standards%20Document.pdf

North Carolina State Board of Education. (2010, November). *Policies on the Beginning Teacher Support Program.*

Olsen, B. (2008). Introducing *teacher identity* and this volume. *Teacher Education Quarterly, 35*(3), 3–6.

Patterson, N. C, Roehrig, G. H., Austin, B., & Luft, J. A. (2003). ASIST: An induction program for science teachers. In J. Rhoton & P. Bowers (Eds.), *Science teacher retention: Mentoring and renewal* (pp. 113–121). Arlington, VA: NSTA Press.

Roehrig, G. H., & Luft, J. A. (2006). Does one size fit all? The induction experience of beginning science teachers from different teacher-preparation programs. *Journal of Research in Science Teaching, 43*(9), 963–985.

Schram, T. H. (2006). *Conceptualizing and proposing qualitative research*. Upper Saddle River, NJ: Pearson.

Smith, T. M., & Ingersoll, R. M. (2004). What are the effects of induction and mentoring on beginning teacher turnover? *American Educational Research Journal, 41*(3), 681–714.

Spradley, J. P. (1980). *Participant observation*. New York: Holt, Rinehart and Winston.

Stoll, L., Bolam, R., McMahon, A., Wallace, M., & Thomas, S. (2006). Professional learning communities: A review of the literature. *Journal of Educational Change, 7,* 221–258.

Supovitz, J. A. (2002). Developing communities of instructional practice. *Teachers College Record, 104*(8), 1591–1626.

Tomasek, T. M., Matthews, C. E., & Hall, J. (2005). What's slithering around on your school grounds? *American Biology Teacher, 67,* 419–425.

Villani, S. (2002). *Mentoring programs for new teachers: Models of induction and support*. Newbury Park, CA: Corwin Press.

Wang, J., & Odell, S. (2002). Mentored learning to teach according to standards-based reform: A critical review. *Review of Educational Research, 72*(3), 481–546.

Wei, R. C., Darling-Hammond, Andree, A., Richardson, N., & Orphanos, S. (2009). *Professional learning in the learning profession: A status report on teacher development in the U.S. and abroad.* Dallas, TX: National Staff Development Council.

Wells, G., & Claxton, G. (2002). Introduction: Sociocultural perspectives on the future of education. In G. Wells & G. Claxton (Eds.), *Learning for life in the 21st century: Sociocultural perspectives on the future of education* (pp. 1–17). Malden, MA: Blackwell.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York, NY: Cambridge University Press.

Williams, J. (2010). Constructing a new professional identity: Career change into teaching. *Teaching and Teacher Education, 26,* 639–647.

Windschitl, M., Thompson, J., & Braaten, M. (2011). Ambitious pedagogy by novice teachers: Who benefits from tool-supported collaborative inquiry into practice and why? *Teachers College Record, 113*(7), 1311–1360. http://www.tcrecord.org ID Number: 16061. Accessed: January 24, 2011.

Wood, D. R. (2007). Professional learning communities: Teachers, knowledge, and knowing. *Theory into Practice, 46*(4), 281–290.

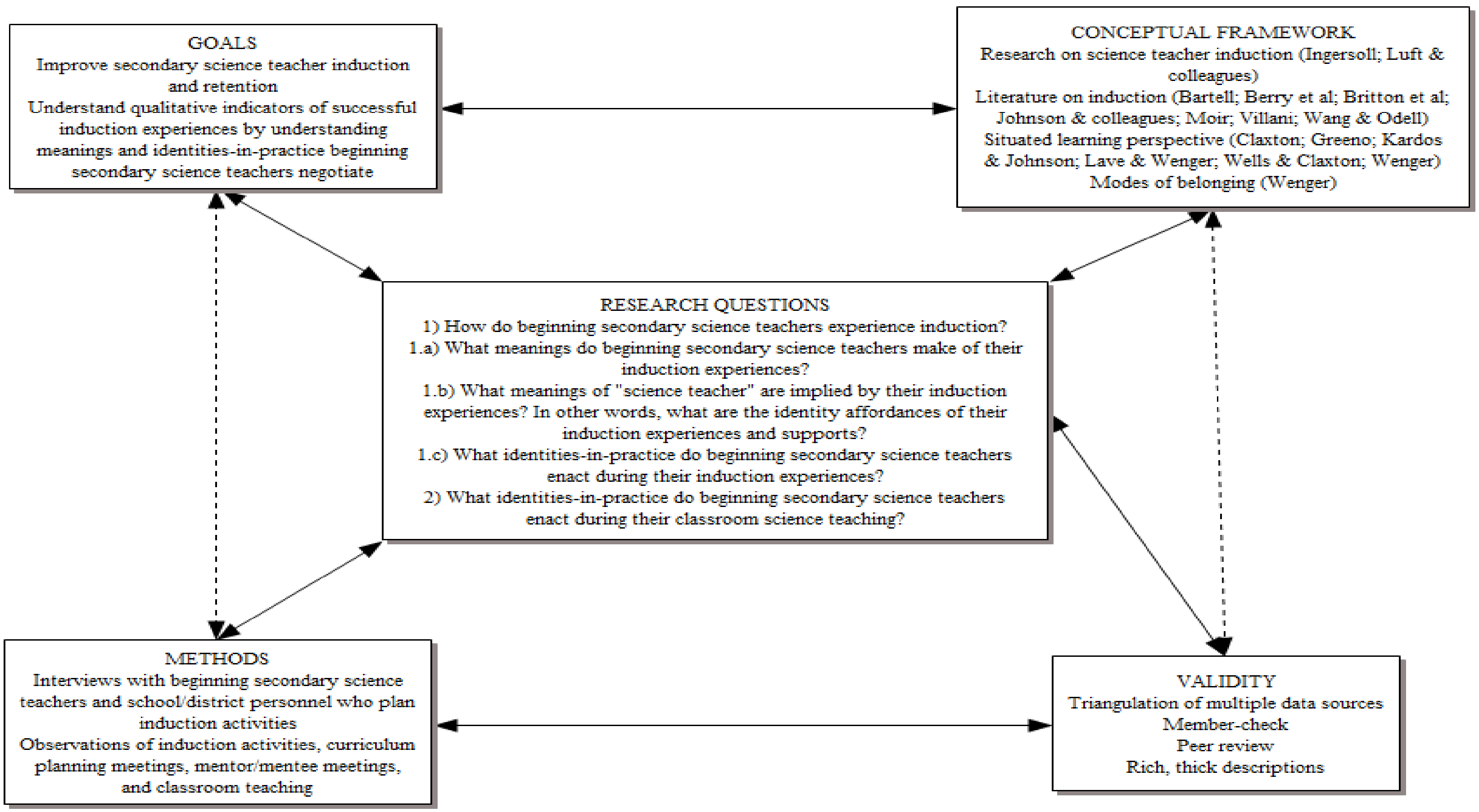
Wortham, S. (2006). *Learning identity*. New York, NY: Cambridge.

Yerrick, R. K., Ambrose, R., & Schiller, J. (2008). Ascribing legitimacy: Pre-service teachers construction of science teaching expertise in multiple communities. *Electronic Journal of Science Education, 12*(2), 132–170.

APPENDIX A

RESEARCH DESIGN OF DISSERTATION

(adapted from Maxwell, 2005, p. 9)



APPENDIX B

INTERVIEW WITH SCHOOL OR DISTRICT PERSONNEL

Script:

(Participant), thank you for allowing me the opportunity to interview you today. As you know, I am very interested in learning about the induction experiences of beginning science teachers. I am trying to better understand the programs and activities in which beginning teachers participate as part of their induction.

Interview Protocol:

1. How would you describe today's planned induction activities?
2. What would constitute "success" for today's activities?
3. What messages do you hope beginning teachers walk away with?

APPENDIX C

INITIAL INTERVIEW WITH BEGINNING SCIENCE TEACHER

Script:

(Participant), thank you for allowing me the opportunity to interview you today. As you know, I am very interested in learning about the induction experiences of beginning secondary science teachers. I am trying to better understand how you, as a beginning science teacher, define what it means to be a successful science teacher, engage in various induction experiences, and make meaning of those induction experiences.

Interview Protocol:

1. What experiences led you to become a science teacher?
    a. How would you describe your teacher preparation/training?
2. What vision do you have yourself as a science teacher?
3. From your perspective, what does it mean to be a successful science teacher?
    a. Where do those meanings come from?
    b. Anywhere else? (continue until sources are no longer identified)
4. What do you hope to gain from your induction experiences?
5. What do you think you will need from:
    a. Mentors?
    b. Colleagues?
    c. Administrators?
6. What other kinds of support do you anticipate needing?

7. What things are you confident about (do not anticipate needing support with) as you get ready to start the school year?

APPENDIX D

FOLLOW-UP INTERVIEW WITH BEGINNING SCIENCE TEACHERS

Script:

(Participant), thank you for allowing me the opportunity to interview you today. As you know, I am very interested in learning about the induction experiences of beginning secondary science teachers. I am trying to better understand how you, as a beginning science teacher, define what it means to be a successful science teacher, engage in various induction experiences, and interpret possible intersections of your induction experiences and your practice. Also, I'm interested in whether those meanings change over time and with experiences.

Interview Protocol:

1. Tell me about all of the ways, both formally and informally, you have been supported in your development as a teacher.
    a. Describe these experiences.
        1. What did you learn from each?
    b. Rank the importance of the experiences.
2. What, as a developing teacher, do you need at this point?
    a. Describe these needs.
    b. What is most critical to you at this point?
3. Are your needs as a new teacher being met?
    a. If so, how?

   b. If not, why not?

4. What do you feel confident about (do not need) at this point?
5. To you, what does it mean to be a successful science teacher?
6. Are you being able to realize this vision for yourself?
   a. What supports do you perceive?
   b. What obstacles do you perceive?
7. Do you think those responsible for planning your professional development and induction activities would define success as a science teacher in the same ways you do?
   a. If so, in what ways?
   b. If not, why not?

APPENDIX E

OBSERVATION OF INDUCTION ACTIVITIES

Participant: beginning science teachers

Activity: school district induction activities

Place: to be determined by school district

1. What induction activities are occurring?
    a. Describe them in detail.
2. How are the beginning secondary science teachers participating in these activities?

Interview with Beginning Science Teachers Following Induction Activities

Interview Protocol:

1. What were your perceptions of today's induction activities?
2. What did you need from today's induction activities?
3. Did you gain what you needed?
    a. If so, how so?
    b. If not, how not?

APPENDIX F

OBSERVATION OF CURRICULUM PLANNING/PLC MEETING

Participant: beginning science teacher

Activity: curriculum planning meeting

Place: high school science classroom

1. In what ways does the beginning teacher engage in the planning meeting?
2. How do more experienced teachers react to the beginning teacher's interactions?

Interview with Beginning Science Teachers Following Curriculum Planning/PLC Meetings

Interview Protocol:

1. What were your perceptions of today's induction activities?
2. Did you gain from them what you believe you needed?
    a. If so, what did you gain?
    b. If not, why not and what were you hoping to gain?

APPENDIX G

OBSERVATION OF MENTOR/MENTEE MEETING

Participant: beginning science teacher

Activity: mentor/mentee meeting

Place: high school classroom

[This “observation protocol” will be used when listening to the audio-recorded mentor/mentee meetings. In listening to the interview and reading the transcripts, consider the following questions.]

1. What topics/issues are discussed during the mentor/mentee meeting?
2. In what ways does the beginning science teacher engage in the mentor/mentee meeting?

APPENDIX H

OBSERVATION OF CLASSROOM SCIENCE TEACHING

Participant: beginning science teacher

Activity: classroom science teaching

Place: high school science classroom

1. What major activity structures occur during the lesson?
   a. Describe them in detail.
2. How does the beginning science teacher engage with the students?
3. How do students interact with the beginning science teacher?

Interview with Beginning Science Teacher Following Classroom Observation

Interview Protocol:

1. What vision did you have for today's lesson?
2. How does the reality of today's lesson differ from that vision?
3. What visions do you have for this same lesson in the future?
   a. Next class period? Next semester? Next year?
4. How would you characterize your interactions with students during today's lesson?
   a. Probe about any notable interactions that occurred during today's observation.

APPENDIX I

CONTACT SUMMARY

Participant:

Contact Date:

Today's Date:

1. What main issues or themes struck you in this contact?
2. Summarize the information you got (or failed to get) on each of the target questions you have for this contact.
3. Anything else that struck you as salient, interesting, illuminating, or important in this contact?
4. What new or remaining questions do you have in considering the next contact?

APPENDIX J

LIST OF START CODES

(based on Miles & Huberman, 1994, p. 59)

Descriptive Labels	Codes	Associated Research Question
Formal Induction Program	FIP	1a, 3
FIP: Orientation	FIP-O	
FIP: Mentor	FIP-M	
FIP: Supportive Communication	FIP-SComm	
FIP: Common Planning	FIP-CP	
FIP: Beginning Teacher Seminars	FIP-BTS	
FIP: External Network of Teachers	FIP-EN	
FIP: Reduced Preparations	FIP-RP	
FIP: Assigned Teacher's Aide	FIP-TA	
FIP: Support Coach	FIP-SCoach	
Informal Induction Experiences	IIE	1b, 3
IIE: Students	IIE-S	
IIE: Teachers	IIE-T	
IIE: Administrators	IIE-A	
IIE: Content-focused Seminars	IIE-CS	
IIE: Other	IIE-O	
Meanings	M	2
M: Redirects	M-M	
M: Dismisses	M-D	
M: Reinterprets	M-R	
M: Modifies	M-M	
M: Confirms	M-D	
Identity	I	4
I: Engagement	I-E	
I: Imagination	I-I	
I: Alignment	I-A	
Needs	N	2, 3
N: Personal/Emotional	N:P/E	
N: Instructional	N:I	
N: Political	N:P	
N: Time	N:T	

Descriptive Labels	Codes	Associated Research Question
Supports	S	1a, 1b, 2, 3
S: Induction Activities	S:IA	
S: Mentor	S:M	
S: Instructional	S:I	
S: Colleague	S:C	
S: Administrator	S:A	
S: Researcher	S:R	
S: Other	S:O	
Pressures	P	1a, 1b, 3
P: Administrators	P:A	
P: Testing/Accountability	P:T	
P: Standards/Pacing Guide	P:S	
P: Family	P:F	
P: Time	P:Time	

APPENDIX K

EXAMPLE OF TAXONOMIC ANALYSIS

(Adapted from Spradley, 1980, p. 114)

Taxonomy of Kinds of Topics Covered During Induction Activities

<table>
<tr><td rowspan="30">Kinds of Topics Covered During Induction Activities</td><td rowspan="13">Covered by district and/or school personnel</td><td colspan="3">Mentors</td></tr>
<tr><td colspan="3">Colleagues</td></tr>
<tr><td colspan="3">Students</td></tr>
<tr><td colspan="3">Celebrations and accolades</td></tr>
<tr><td rowspan="3">Instruction</td><td colspan="2">Teaching practices</td></tr>
<tr><td colspan="2">Observations of teaching</td></tr>
<tr><td colspan="2">Classroom management</td></tr>
<tr><td rowspan="6">End of semester/end of year</td><td rowspan="3">Policies and procedures</td><td>Make-up time</td></tr>
<tr><td>Grade recovery</td></tr>
<tr><td>Closing procedures</td></tr>
<tr><td rowspan="2">Exams</td><td>Schedule</td></tr>
<tr><td>Exemptions</td></tr>
<tr><td colspan="2">Next year</td></tr>
<tr><td rowspan="10">Taken up by beginning secondary science teachers</td><td colspan="3">Colleagues</td></tr>
<tr><td colspan="3">Students</td></tr>
<tr><td colspan="3">Celebrations and accolades</td></tr>
<tr><td rowspan="4">Instruction</td><td colspan="2">Teaching practices</td></tr>
<tr><td colspan="2">Planning</td></tr>
<tr><td colspan="2">Observations of teaching</td></tr>
<tr><td colspan="2">Classroom management</td></tr>
<tr><td rowspan="3">End of semester/end of year</td><td rowspan="2">Policies and procedures</td><td>Make-up time</td></tr>
<tr><td>Closing procedures</td></tr>
<tr><td colspan="2">Next year</td></tr>
<tr><td rowspan="7">Questions asked by beginning secondary science teachers</td><td colspan="3">Celebrations and accolades</td></tr>
<tr><td rowspan="3">Instruction</td><td colspan="2">Teaching practices</td></tr>
<tr><td colspan="2">Planning</td></tr>
<tr><td colspan="2">Observations of teaching</td></tr>
<tr><td rowspan="3">End of semester/end of year</td><td>Policies and procedures</td><td>Closing procedures</td></tr>
<tr><td>Exams</td><td>Writing non-EOC exams</td></tr>
<tr><td colspan="2">Next year</td></tr>
</table>

APPENDIX L

EXAMPLE OF COMPONENTIAL ANALYSIS

(Adapted from Spradley, 1980, p. 136)

Paradigm Worksheet for Kinds of Supports

			Type of Support Provided			Accessed By[c]			
Domain	**Frequency[a]**	**Location[b]**	**Emotional**	**Instructional**	**Procedural**	**Sophia**	**Ingrid**	**Jessica**	**Whitney**
District Orientation	Once at start of school year	District-level		X	X	X	X	X	X
Induction and Success Coach	Twice monthly	District-level support occurred at teachers' schools	X	X		X	X	X	X
Induction Coordinator	Monthly during beginning teacher meetings and as needed	School-based		X	X				X

Paradigm Worksheet for Kinds of Supports (cont.)

			Type of Support Provided			Accessed By[c]			
Domain	**Frequency[a]**	**Location[b]**	**Emotional**	**Instructional**	**Procedural**	**Sophia**	**Ingrid**	**Jessica**	**Whitney**
PLC	Weekly	School-based		X	X	X	X	X	X
District's Content-Focused Seminars	Monthly	District-level		X		X	X		X
District's Online Instructional Resources	As needed	District-level		X		X			X

Note. This componential analysis is based on observation and interview data.
[a] Considered frequency at which these supports were offered rather than how frequently they were attended by participants.
[b] Considered whether support occurred at the district-level or was school-based.
[c] Considered whether participants attended and participated in the support rather than whether they ascribed valued to the support.